MEMOIRS
OF THE
Royal Society;

Being a New ABRIDGMENT of the

Philosophical Transactions:

Giving an ACCOUNT of the Undertakings, Studies, and Labours of the LEARNED and INGENIOUS in many considerable Parts of the WORLD; from the first Institution of that ILLUSTRIOUS SOCIETY in the Year 1665, to the Year of our LORD 1735 inclusive.

The whole carefully abridg'd from the Originals, and the Order of Time regularly observ'd, with a Translation of the LATIN TRACTS, and the Theoretical Parts apply'd to Practical Uses; also an Explanation of the Terms of ART as they occur in the Course of the Work. Being a Work of general Use to the Publick, and worthy the Perusal of all MATHEMATICIANS, ARTIFICERS, TRADESMEN, &c. for their Improvement in various Branches of Business.

By Mr. BADDAM.

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M,DCC,XLI.

MEMOIRS

OF THE

ROYAL SOCIETY;

Being a New ABRIDGMENT of the

PHILOSOPHICAL TRANSACTIONS.

How Intermitting Fevers are cur'd at Algier; *by Mr.* Shaw. Philoſophical Tranſactions. N° 411. p. 183.

WE have a ſpecies of the *ſcabioſa* at *Algier*, which is of great virtue in curing intermitting fevers. It is not unlike the figure which *Moriſon* gives of his 20th ſpecies *cap* 21. *ſect.* 6. *tab.* 14. or of his 25th ſpecies, *cap.* 21. *ſect.* 6. *tab.* 15, of corymbiferous plants; only the head is not round, as there deſcrib'd. Mr. *Shaw*, therefore, calls it, *ſcabioſa flore pallido purpureo, capitulo oblongo, foliis ſuperioribus inciſis, inferioribus integris, ſerratis.* The method of preparing it is to put a handful of it into a quart of water, and boil it away to a pint. A coffee-diſh full of this decoction, is given the patient faſting, a little before dinner, and at night without any regard to the interval or intermiſſion of the fit, as in giving the bark; and it commonly operates by ſtool or urine. Mr. *Shaw* only ſaw this plant at *Algier*, *Oran*, *Gibraltar* and mount *Libanus*, where he was firſt acquainted with its extraordinary qualities.

Some of the Effects and Properties of Damps; by Mr. Iſaac Greenwood. Phil. Tranſ. N° 411. p. 184.

ON the evening of *July* 19. 1729. One Mr. *Adams* and his ſervant being employ'd to repair a pump in *Boſton* in *New England*, uncover'd the well; upon which the former immediately attempted to go down by means of a ſingle rope only; but he had not deſcended above five or ſix feet, before he was render'd incapable of ſuſtaining his own weight; and without ſpeaking, or giving any ſings of diſtreſs, he ſlipp'd down ſuddenly to the upper part of the joint of the pump; where being ſupported about a minute, and fetching his breath in a very diſtreſs'd manner, he fell down to the bottom, which was eight or ten feet lower, and cover'd with but a very few inches of water, without diſcovering any ſigns of life. Upon this his ſervant with great precipitation took the rope in his hand, in order to go down to his maſter's relief: But at the ſame diſtance from the top, he met with the ſame fatal interruption; and without diſcovering any ſigns of diſtreſs, he was heard to fall to the bottom.

The workmen above prepar'd a third with a tackle about his waiſt: Upon his going down he became ſpeechleſs; and made no ſigns at all, tho' he had agreed to it: Whereupon being rais'd from the well, he appear'd ghaſtly; but upon the uſe of proper means he was ſoon recover'd; without remembering any thing particular that had paſt.

Some hours after this the other bodies were taken up; but with all the marks of a violent death upon them,

There was nothing particular as to this well; only that it was ſituated near the town-dock, the reſervoir or common-ſewer of the neighbouring ſtreets. It is about 30 foot deep, which in this place is ſo conſiderable, that it is lower than the ſurface of the water at the greateſt ebb. There had not been an air-tube, or paſſage for the external air to communicate with it for ſome conſiderable time.

The ſame evening ſeveral trials were made on deſcending lights, particularly by letting down lighted candles uncover'd, others inclos'd in lanthorns, and others with the lanthorn placed in a pail; but in all theſe trials it was obſerv'd, that whatever the circumſtances of the light were, it never reach'd above ſix feet.

July 20.

July 20. In the evening Mr. *Greenwood* repeated ſuch experiments in the damp, as related to flame, and found the effect much the ſame as before; *viz.* in about ſix feet below the top of the well, the flame would become dim, and if not immediately rais'd, would change to a blueiſh colour, and become more and more contracted or diminiſh'd, till in about a minute's time it would be entirely extinguiſhed, without any remains or ſtench, accompanying the wick. In theſe experiments he particularly obſerv'd, that the flame in all its changes ſtill continued its pyramidal figure; nor did a quicker or ſlower deſcent make any alteration in theſe circumſtances. One experiment was very particular, relating to the flame of a candle. He took a common pail, and having fix'd a candle to its bottom, erect, and about eight inches long, he pour'd as much hot water into the pail, as reach'd within a quarter of an inch of the blaze of the candle. Then having carefully lower'd the pail down the well; the flame, notwithſtanding it was defended by the reeking ſteams of hot water, went out at the ſame depth, and in the ſame time as before. After this he immers'd burning coals, flaming brimſtone, and lighted matches, all which were extinguiſhed with very little difference as to the time or other circumſtances.

Two experiments were made relating to animal life. A large kitten was very much affected in about a minute's time; and after three minutes become ſo weak, that after ſhe was taken out, ſhe could not ſtand on her legs: Being at length pretty well recovered, ſhe was carefully bound up in a ſilk handkerchief, that ſhe might be the more eaſily ſuſpended; and letting her down about 16 or 18 feet, in three minutes ſhe was affected in the like manner as before, making a very diſtreſt noiſe, and in about five minutes ſhe was in ſuch extraordinary convulſions, as rendered the ſight not a little diſagreeable: But in theſe throws ſhe diſengaged herſelf, and fell to the bottom, without making any efforts to ſwim: Whence he concluded they were the laſt ſtruggles for life, in which ſhe broke looſe.

He tried the ſame fatal experiment upon a ſmall bird; which being ſuſpended in the damp about three minutes, was found entirely ſenſeleſs, and according to all appearance paſt recovery. Upon taking it in his hand he found it very cold, and without the leaſt motion, that he could diſcover: However, keeping it cloſe between his hands, which were pretty

pretty warm, in about a minute he felt a ſmall palpitation, which preſently increaſed to a ſtronger pulſe; till in about 6 or 7 minutes the bird was reſtored to a perfect and uninterrupted reſpiration. About half an hour after, he again put the bird into the damp, and continued it there about 5 minutes, after which he found it paſt recovery.

July 21. Mr. *Greenwood* repeated ſeveral of the experiments relating to lights and flame, which ſucceeded with very little (if any) alteration, as before; which he look'd upon as an undoubted confirmation of the continuance of the damp. Upon which he proceeded, firſt, to examine the elaſticity of the air in the well, by letting down a ſmall bell; the ſound of which was as diſtinct and loud as in any ordinary well of the ſame depth.

Then in order to diſcover the degree of moiſture, he took a large ſpunge, a little wet, which with the ſilk ſtring it was let down by, weighed 278 grains. This being ſuſpended in the damp, upwards of five minutes, and then rais'd, was carefully weigh'd, and found to be of the ſame weight preciſely. After this he dried the ſpunge, which then weighed but 261 grains; and having applied it to the damp for the ſpace of 10 minutes, he likewiſe found, that it had not gain'd the leaſt perceivable weight. In like manner, a large bundle of *catgut*, weighing two ounces, 15 penny weight, 10 grains, did not acquire the leaſt addition of weight, by being ſuſpended therein for a conſiderable time.

To theſe experiments he added one upon the hydroſtatical balance, in order to determine whether there were any difference as to the denſity, or ſpecific gravity of common and this vitiated air. The balance was very large, and accurately pois'd; and the ſolid, which was a globe, was four inches eight tenths in diameter. This together with its ſtring weighed in the air ſeven ounces, ſix penny weight; and after immerſing it in the damp, it loſt nothing of its weight; being then in *æquilibrio* to ſo great a degree of exactneſs, that half a grain would preponderate on either ſide.

This damp abated more and more, by being expos'd to the air; till on *July* 25. perſons were let down to the bottom without any inconveniency.

The other inſtance Mr. *Greenwood* gives is of a very ſudden ſubterraneous vapour on *May* 9, 1729, in a well in *School-houſe-ſtreet*, *Boſton*.

This

This well had been open'd for ſome conſiderable time; and not only enlarged in its diameter, but dug fourteen or fifteen feet deeper. Upon which one Mr. *Rennief*, and a young man called *Ruſſel*, undertook to lay the ſtones. They had been employ'd all the day, till about ſix o' clock in the evening, when *Rennief* perceiv'd a very unuſual ſtench, with which he firſt upbraided his partner as an act of indecency; till by the extraordinary increaſe thereof, he was apprehenſive of ſome greater danger. *Ruſſel* was hitherto inſenſible of it; but perceiving his partner's viſage to change to a very uncommon degree, called up for help; at which inſtant, as he afterwards expreſſed himſelf, *he firſt perceived a very ſtrong noiſome ſmell, like rotten fiſh, which on a ſudden ſeis'd his ſenſes, and render'd him unable to ſuſtain his own weight. Rennief* had directly cloſed his mouth and noſtrils with his hand; and when the bucket was lowered with a third perſon for their relief, he aſſiſted in getting *Ruſſel* into it. As the bucket was raiſing, *Ruſſel* was taken with very unuſual and extraordinary fits; and when he was laid upon the ground, till *Rennief* was taken out, he could hardly be kept ſtill by the united ſtrength of 3 or 4 perſons; but bounding and writhing his body, like a fiſh newly taken out of the water. *Rennief* was affected only with fainting fits. After 3 hours *Ruſſel* recovered of theſe extraordinary convulſions; but was diſorder'd in his brain all the night; and tho' *Rennief* was ſooner relieved of his fits, he continued exceedingly diſordered for a longer time. It was thought remarkable, that neither of them was affected either with vomiting or purging.

This accident happened on *Friday*, and on the *Monday* they were both reſtored to perfect health. The well continued infected for a very little while; and when on the *Monday* following ſome others renewed the work, nothing noiſome could be perceived.

Mr. *Greenwood* does not remember, that there is any inſtance of ſuch a tranſient vapour or damp, recorded in the *Philoſophical Tranſactions*; and owns himſelf at a loſs to account for it, ſhould there be ſubterraneous exhalations, which, like the clouds or wind in the atmoſphere, ſhifted from one place to another, it might be of conſiderable importance to obſerve the particulars thereof; eſpecially, ſuch as are malignant, as this was. The paſſage of this vapour was about 25 feet below the ſurface; a depth too great for it to affect cellars or vaults.

It

It is to be noted that this part of *Boston* lies very high; and the ground for about 10 foot, hard clay; and the rest a course sand and gravel.

An Account of an ancient Well *near* Queenborough *in* Kent; *by Mr.* Peter Collison. Phil. Trans. N° 411. p. 191.

THE king's officers of *Sheerness* and *Chatham* (by order of the Commissioners of the *Navy*) met *Sept.* 24, 1723, at the well near *Queenborough*, where the castle formerly stood, and upon sounding it finding but very little water at the bottom; and it having a new curb, fixt on the top, they provided themselves with buckets and ropes, and lowered down a man, who acquainted them it was clean'd, and the ground sunk 4 feet deeper than the curb at the bottom. They then measur'd its depth and found it 200 foot, and artificially steened the whole depth with circular *Portland* stone, which is all entire and stands fair, the mean diameter being 4 foot, and 8 inches: But observing that not a drop of water came into it, they resolved to try, whether they could find any by boring; in order to this they procured a piece of timber about 7 foot long, and boring it thro' with a three inch and a half augre, they fixed this trunk at the bottom of the well, and fastened it by quarters to the curb at the bottom, to prevent its rising, and filled it all round 3 foot deep with clay, and on that laid 4 course of bricks for a platform for the men to stand on in boring, and likewise procured an augre of 2 inches and ½, to bore thro' the clay; when *Sept.* 26. 3 men at a time began to bore, who were shifted every 3 hours: The boring they sent up was a very close bluish clay, which continuing the same after 3 days and ½ boring, they began to despair meeting with water; but on the 30. of *Sept.* in the evening, as they were boring, the augre slipt down at once, and up came water; and in an hour's time there was upwards of 4 foot water which rose so fast, that at 12 o'clock at noon

		feet	inches
On the 1. of *October* there was		55	10
2. at 5	in the afternoon	109	8
3. at 3	in the afternoon	132	6
4. at 3	in the afternoon	149	6
5. at 4	in the afternoon	161	3
6. at 10 ½	the morning	167	8
7. at 4	in the afternoon	174	0
8. at 7	in the morning	176	7

and it still increased, tho' slowly.

The

The reaſon of its not riſing ſo much now as at firſt, they apprehended was owing to the weight of the water, which the ſpring muſt force up thro' the hole of the trunk, and the well being wider above than below. What they took to be very extraordinary was, that they bored 81 feet below the foot of the trunk, before they met with this body of water, which by computation is 166 feet below the deepeſt place in the adjacent ſeas. The water proves very good, ſoft, ſweet and fine: They compared it with the beſt ſpring water brought from *Milton*: and in every body's opinion that taſted both, they declared the well-water the beſt. They put ſome ſoap to it, and it lather'd finely; they boiled old peaſe in it, which performed very well; and they had great reaſon to believe, that the ſpring would ſufficiently ſupply his Majeſty's ſhips, as propoſed.

Obſervations made in England *and* Italy *on the* Meteor *called the* Ignis Fatuus; *by Mr.* Derham. Phil. Tranſ. N° 411. p. 204.

IT being the opinion of divers ſkillful naturaliſts (particularly Mr. *Francis Willoughby* and Mr. *Ray*) that the *ignes fatui* are only the ſhining of a great number of the male glow-worms in *England*, or of the *pyrauſtæ* in *Italy*, flying together, Mr. *Derham* had a mind to conſult his curious and ingenious friend Sir *Thomas Dereham* about the phenomenon, being informed, that thoſe *ignes fatui* are common in all the parts of *Italy*. But of the *pyrauſtæ*, or fire-flies, he never obſerved any ſuch effects, tho' there be a vaſt number of them in *June* and *July*: He moreover ſays, that theſe *pyrauſtæ* are called *Lucciole*, *i. e.* ſmall lights, and that they are not the *farfalls* (as Mr. *Ray* thought) which are butterflies.

But Mr. *Derham* had good reaſon to think that inſects are not concerned in the *ignes fatui*, from the following obſervations; the firſt of which he himſelf made, and the others he received from *Italy*.

Mr. *Derham* made his own obſervation at a place that lay in a valley between rocky hills, which he ſuſpects might contain minerals, in ſome boggy ground near the bottom of thoſe hills: Where obſerving one in a calm, dark night, with gentle approaches he got up by degrees within two or three yards of it, and view'd it with all the care he poſſibly could: He found it friſking about a dead thiſtle, growing in the field, till a ſmall motion of the air (even ſuch as was cauſed only by his drawing near it) made it ſkip to another place, and thence to another, and ſo on: So that he took it for a fired vapour.

The male glow-worms he knows emit their ſhining light, as they fly; by which means they diſcover and woo the females; but he never obſerved them to fly together in ſo great numbers, as to make a light equal to an *ignis fatuus*. And he was ſo near, that had it been the ſhining of glow-worms, he muſt have ſeen it in little diſtinct ſpots of light; whereas it was one continued body of light.

Mr. *Derham* next gives an account of the obſervations of the *ignes fatui*, procured for him in *Italy*, in the following letter of Dr. *Giacomo Bartholomeo Beccari* to Sir *Thomas Dereham*, dated at *Bologna*, *Oct.* 23, 1728.

'I ſend you the following obſervations on the *ignes fatui*. 'What I am now going to offer you, concerning theſe fiery appearances, is the reſult of ſeveral converſations I had upon 'this ſubject with ſeveral experienced travellers, men of learning and reputation, whoſe ſincerity I had no reaſon to miſtruſt. 'For my own farther ſatisfaction, ever ſince I received your commands, I have made it my buſineſs to ſpeak with as many as 'I could light of, with ſuch as travell'd much in the mountains, 'and with others that obſerved them in plains, on purpoſe to 'ſee whether or no the difference of the place made any ſenſible 'difference in the appearance. I find upon the whole, that they 'are pretty common in all the territory of *Bologna*. To begin 'with the plains, they are very frequently obſerved there; the 'country people call them *Cularſi*, probably, from ſome fancied 'reſemblance to thoſe birds; and becauſe they look upon them 'as birds, the belly and other parts of which are reſplendent 'like our ſhining flies. They are moſt frequent in watery and 'moraſſy ground; and there are ſome ſuch places, where one 'may be almoſt ſure of ſeeing them every night, if it be dark. 'In the fields near the bridge *Della Calcarata*, in a common, 'belonging to the pariſh of S. *Maria in dono*, north of *Bologna*, 'one of theſe fiery appearances is very often obſerved to move 'a-croſs the fields, coming from another bridge, called *Della foſſa quadra*. There is another of them in the fields of *Bagnara*, almoſt eaſt of *Bologna*, which ſcarce ever fails to appear in dark nights; particularly when it rains or ſnows; as 'alſo in cold and froſty weather: Both theſe, I mean that near 'the bridge of *Calcarata*, and that in the fields of *Bagnara*, 'are very large; and I am aſſur'd, that ſometimes their light is

'equal

'equal to that of one of our ordinary faggots, or bundles mad 'of vine-branches; and that it is ſcarce ever leſs than that of 'the links which our country people make of hemp-ſtalks, and 'which they light themſelves withal, when they travel in the 'night. That at *Bagnara* appeared, not long ſince, to a Gen-'tleman of my acquaintance, as he was travelling that way; it 'kept him company for a mile or better, conſtantly moving be-'fore him, and caſting a ſtronger light on the road, than the 'link he had with him.

'I believe there may be ſeveral more in other plains, as large 'as theſe two; tho' at preſent I have not been able to get cer-'tain information of any others. Leſſer ones there appear a 'good many; ſome of them giving as much light, as a lighted 'torch; and ſome are no bigger than the flame of a common 'candle. Of theſe I have been aſſur'd a good many have been 'obſerved in the fields of *Bariſella*. All of them have the 'ſame property, in reſembling, both in colour and light, a 'flame ſtrong enough to reflect a luſtre upon neighbouring objects 'all round. They are continually in motion; but this motion 'is various and uncertain. Sometimes they riſe up; at other 'times they ſink. Sometimes they diſappear of a ſudden, and 'appear again in an inſtant in ſome other place. Commonly 'they keep hovering about ſix foot from the ground. As they 'differ in largeneſs, ſo they do in figure, ſpreading ſometimes 'pretty wide, and then again contracting themſelves. Some-'times breaking to all appearance into two, and a very little 'while after uniting again into one body; ſometimes floating 'like waves, and letting drop ſome parts, like ſparks out of a 'fire. I have been aſſured, that there is no dark night all the 'year round, in which they do not appear. And in the very 'middle of winter, when the weather is very cold, and the 'ground covered with ſnow, they are obſerved more frequently 'than in the hotteſt ſummer. The Gentleman, who gave me 'an account of that at *Bagnara*, told me, that if I had a mind 'to ſee it myſelf, I might be ſure of finding it, if I went thither 'in very cold weather; and in a ſharp froſt. Nor doth either 'rain or ſnow in any wiſe prevent or hinder their appearance: 'On the contrary, they are more frequently obſerved, and caſt 'a ſtronger light in rainy and wet weather. This laſt circum-'ſtance, it is true, has been taken notice of by ſome writers, 'and among the reſt, if I remember right, by the learned *Gaſ-'ſendus*. Nor does the wind much hurt them; tho' one ſhould 'think, that if it were a burning ſubſtance, like common fire;

'it ſhould either be diſſipated in windy weather, or extin-
'guiſhed by rain. But ſince they do not receive any damage
'from wet weather; and ſince, on the other hand, it hath never
'been obſerved, that any thing was thereby ſet on fire; tho'
'they muſt needs in their moving too and fro, meet with a
'good many combuſtible ſubſtances; it may thence be very
'reaſonably inferred, that they have ſome reſemblance to that
'ſort of phoſphorus, which doth, indeed, ſhine in the dark;
'but doth not burn any thing, as common fire doth: Nor is
'there any thing extraordinary in this any more than in other
'fiery appearances, which likewiſe are pretty common, and a-
'gree with the *ignes fatui*, in having only the ſplendor and
'appearance of fire, without the quality of burning, but differ
'from them in a good many other particulars. Such a phe-
'nomenon was obſerved by a noted Clergyman of *Bologna*
'one ſummer's evening, near ſome country people's houſes.
'The flame ſeemed to him ſo ſtrong, that he called to them
'to put it out, for fear it ſhould reach a hay-loft, and a heap
'of hemp, that lay not far from it: But when he came to the
'very place where he had firſt ſeen the flame, he perceiv'd
'that it was only an appearance, obſerving not the leaſt trace
'of fire; tho' he aſſur'd me there lay a good deal of combuſ-
'tible ſtuff all thereabouts, which would have eaſily took fire,
'if there had been any thing of an actual flame upon the
'ſpot. The ſame Gentleman told me, that in a very dry
'ſummer, he obſerv'd, in the middle of ſome other fields of
'his own, for ſeveral evenings together, a pretty conſiderable
'flame on the ground, nearly in the ſame place, and that
'having reſolved to go and take a nearer view of it the next
'evening, it did not appear for that time; that however he
'went to the ſame place where he had before ſeen it, and ſet
'himſelf down on the ground; but could not obſerve the leaſt
'mark of any fire or flame having been on that ſpot, nor feel
'any heat in the ground any more than in other places; only
'he obſerv'd ſome ſlight flames, ariſing out of the ground hard
'by; which diſappear'd as ſoon as they came into the open
'air. It is well known to people that travel on horſeback
'at the beginning of the night, in the heat of ſummer, when
'they traverſe the dry beds of rivers, and break with the
'horſes feet thoſe ſandy grounds that have been all day long
'ſtrongly heated by the ſun, there riſe up ſome bluiſh flames,
'which very often frighten the horſes. This phenomenon is
'moſt common in thoſe places where the water hath left behind

'a kind

'a kind of a chalky ſediment, or fat earth, which drying af-'terwards forms a thick hard cruſt. So in like manner if in 'the heat of ſummer you travel in dark nights, either on horſe-'back, or on foot, over the parched ground of ſome fields, you 'ſhall ſee flames break out of the ground almoſt at every ſtep. 'All theſe fire and flames have, it is true the light and ſhining, 'but not the burning quality of fire, whether from the exceed-'ing ſmallneſs or rarity of their parts, as ſome apprehend, or 'for ſome other reaſon, I will not determine. And this is 'the only thing they have in common with the *ignes fatui*, 'differing very much in other reſpects, particularly in not ap-'pearing at all ſeaſons of the year, and moſt frequently in the 'winter, as the others do. Thus far, what I could learn con-'cerning the *will with a wiſp*, as it hath been obſerved in the 'plains.

'As to the appearance of this phenomenon in mountainous 'parts, by what I have hitherto been able to learn, they differ 'nothing elſe but in largeneſs; and all thoſe I convers'd with, 'that ſaw them in the mountains, agree in that they never ob-'ſerved any larger than the flame of an ordinary candle. Nor 'do thoſe that live in the mountains call them *cularſi*, which 'name is, perhaps, us'd only by the country people in the 'plains for thoſe large ones above deſcribed. The difference 'of the air, and that of the ſoil may, for ought I know, con-'tribute a great deal towards the different ſize of theſe appear-'ances; at leaſt all that I can offer material at preſent towards 'ſolving this particular circumſtance, namely with regard to 'their largeneſs, is, that thoſe grounds where we obſerve the 'largeſt fires, as at *Bagnara*, are what they here call *ſtrong ground* (*terreni forti*) being a hard, chalky and claiey ſoil, 'which will harbour the water a long while, and is afterwards, 'in hot weather, very apt to break into large cracks and fiſſures: 'Whereas on the contrary, thoſe ſoils in the mountains, where 'they obſerve the ſmall fires, are what they call ſoft, or *ſweet ground* (*terreni dolci*) being generally ſandy, and of a more 'looſe contexture, which do not keep the water ſo long as the 'others. Of that ſort alſo is the ſoil in the above mentioned 'plains of *Bariſella*, where about 7 or 8 years before, they ob-'ſerved a good many of the ſmalleſt *ignes fatui* in the fields, 'within the compaſs of about 3 miles.

'According to the beſt informations I have hitherto been able 'to procure, theſe lights are frequently obſerved along the 'banks of brooks and rivers, probably, becauſe the air conveys

'them

'them thither more eaſily than any where elſe. In all other 'particulars, as in their motion, the manner of their appear-'ance, their diſappearing ſometimes ſuddenly, their light, the 'height they riſe to, and their not being cauſed either by rainy 'or cold weather, they are the very ſame with the *cularſi* 'above-deſcribed, or the large *will with a wiſp*, as obſerved 'in the plains.

'I cannot forbear adding the following obſervation, which in 'my opinion is very curious and ſingular; and for which I am 'indebted to a young Gentleman, a very accurate and knowing 'obſerver of natural appearances. Travelling ſome time in '*March* 1728, between 8 and 9 o'clock in the evening, in a 'mountainous road not far from our Lady *Del Sarſo*, about 10 'miles ſouth of *Bologna*, as he approached a certain river cal-'led *Rio verde*, he perceived a light which ſhone very ſtrongly 'upon ſome ſtones that lay upon the banks. It ſeemed to be 'about 2 foot above the ſtones, and not far from the water of 'the river; in figure and largeneſs it reſembled a parallelopi-'ped, ſomewhat above a *Bologneſe* foot in length, and about 'half a foot high, its longeſt ſide lying parallel to the horizon; 'its light was very ſtrong, inſomuch that he could very plainly 'diſtinguiſh by it part of a neighbouring hedge, and the wa-'ter in the river; only in the eaſt corner of it the light was 'pretty faint, and the ſquare figure leſs perfect, as if cut off, or 'darkened by the ſegment of a circle. The Gentleman's curio-'ſity tempted him to examine it a little nearer; in order to 'which he advanced gently towards the place; but was ſur-'priſed to find, that it inſenſibly changed from a bright red to 'a yellowiſh pale colour, in proportion as he drew nearer; and 'that when he came to the place itſelf, it was quite vaniſhed: 'Upon this he ſtepp'd back, and he not only ſaw it again; but 'found that the farther he went from it, the ſtronger and 'brighter it grew; nor could he upon narrowly viewing the 'place where this fiery appearance was, perceive the leaſt black-'neſs, ſmell, or any mark of actual fire. The ſame obſerva-'tion was confirmed to me by another Gentleman, who fre-'quently travels that way, and who aſſur'd me, that he had 'obſerved the very ſame light 5 or 6 different times, in ſpring 'and autumn; and that he had always obſerved it of the very 'ſame ſhape and in the ſame place; which to me ſeems very 'difficult to be accounted for. He told me farther, that once 'he took particular notice of its coming out of a neighbouring 'place, and then ſettling itſelf into the figure above-deſcribed.

'Ho[w]

'How it comes to paſs, that the nearer one approaches to theſe, 'or the like fiery appearances, the fainter they grow, till at 'laſt they entirely diſappear, I very freely own myſelf at a 'loſs; but ſtill I cannot help thinking, that there is ſomething 'in it analogous to what we obſerve in fogs and clouds, 'which at a diſtance have indeed, the appearance of very thick 'bodies, but are found more rare as one gets into them: Nor 'is it improbable, as they muſt be ſomething very thin and 'ſubtile, that upon the approach of groſſer bodies with their 'atmoſpheres they are actually driven away.

'This is the ſubſtance of what I could gather from ſeveral 'accounts relating to the *ignes fatui*: But as to the cauſes 'of them, I will not pretend to aſſign any. I will only add, 'that all that ever obſerv'd any of theſe fiery appearances a-'gree, and you may aſſure Mr. *Derham* of it, that they caſt 'a light quite different from that of the *ſhining flies*; and if 'you pleaſe to reflect on the ſeveral Circumſtances above re-'lated, I believe you will find, that they are not eaſily, if at 'all, to be ſolv'd by that hypotheſis.'

A lunar Eclipſe at Bononia, *by* S. Manfredi, Phil. Tranſ. N° 411. p. 215. *Tranſlated from the* Latin.

True time H.	′	″	Phaſes.
11	56	52	The Eclipſe certainly begun.
12	11	33	The beginning of *Copernicus* immerged.
	12	56	The center of *Copernicus*. But determin'd 2″ ſooner.
	19	46	The beginning of *Tycho* immerged. But determin'd 2″ ſooner.
	20	54	The middle of *Tycho*.
	21	43	*Tycho* entirely immerged.
	23	43	The beginning of *Plato* immerged.
	24	42	The middle of *Plato*
	25	23	*Plato* entirely immerged.
	25	55	*Inſula in ſinu medio* immerged.
	27	35	*Manilius* entirely immerged.
	29	35	*Ariſtoteles*
	32	7	*Menelaus*
	35	0	*Plinius*.
	38	49	*Promontorium ſomni*.
	39	26	*Promontorium acutum*.

True

True Time. H.	′	″	Phaſes.
12	44	16	*Fracaſtorius.*
	45	42	*Proclus.*
	46	59	The beginning of *Mare Criſium* immerged.
	49	47	The middle of *Mare Criſium*: But determined 4″ ſooner.
	52	19	*Mare Criſium* entirely immerged.
	53	6	*Petavius.*
	55	54	The total immerſion of the moon.
14	34	25	The beginning of the emerſion. Doubtful.
	37	30	*Grimaldus* begins to emerge.
	38	20	*Galilæus* entirely emerged.
	38	28	*Grimaldus.*
	39	45	*Ariſtarchus.*
	44	47	*Keplerus* entirely emerged.
	48	33	*Plato* begins to emerge.
	49	37	The middle of *Plato* emerged.
	50	42	*Plato* entirely emerged.
	52	47	*Copernicus.*
	55	32	*Bullialdus.*
15	0	56	*Tycho* begins to emerge.
	2	36	The middle of *Tycho* emerged.
	3	50	*Tycho* entirely emerged.
	4	50	*Manilius.*
	7	47	*Menelaus.*
	11	2	*Dionyſius.*
	11	37	*Plinius.*
	18	53	*Promontorium acutum.*
	20	30	*Mare Criſium* begins to emerge.
	20	59	*Proclus* entirely emerged.
	23	35	The middle of *Mare Criſium* emerged.
	35	0	The end of the eclipſe.

The ſame Eclipſe obſerv'd at Rome, Phil. Tranſ. N°. 411. p. 217.
Tranſlated from the Latin.

Time. H.	′	″	Immerſions.
12	1	0	The ſhadow at the moon's limb.
	7	49	The beginning of *Kepler.*
	9	4	The middle of *Kepler.*
	9	50	The end of *Kepler.*

The

True time. H.	′	″	Phases.
12	15	0	The beginning } of *Copernicus.*
	16	26	The middle } of *Copernicus.*
	17	0	The end. } of *Copernicus.*
	17	11	*Heraclites* begins to immerge.
	17	27	Half immerged.
	17	40	Entirely immerged,
	22	26	*Helicon* begins to immerge.
	22	41	Half immerged.
	23	7	Entirely immerged.
	23	50	*Tycho* begins to immerge.
	24	41	Half immerged.
	25	25	Entirely immerged.
	28	43	*Plato* begins to immerge.
	29	14	Half immerged.
	29	50	Entirely immerged.
	31	5	*Manilius* begins to immerge.
	32	0	Half immerged.
	32	45	Entirely immerged.
	35	4	*Menelaus* begins to immerge.
	35	45	Half immerged.
	36	8	Entirely immerged.
	51	37	*Mare Crisium* begins to immerge.
	54	10	Half immerged.
	56	8	Entirely immerged.
13	0	16	The total immersion.

Time. H.	′	″	Emersions.
14	38	24	The light at the moon's limb.
	43	24	*Grimaldus* entirely emerged.
	44	34	*Keplerus* entirely emerged.
	46	14	*Heraclides* begins to emerge.
	46	54	Half emerged.
	47	24	Entirely emerged.
	49	10	*Helicon* begins to emerge.
	50	4	Half emerged.
	50	44	Entirely emerged.
	51	24	*Plato* begins to emerge.
	52	9	Half emerged.
	52	44	Entirely emerged.
15	7	5	*Tycho* begins to emerge.
	7	13	Half emerged.

Time			Emersions.
H.	′	″	
15	8	18	*Tycho* entirely emerged.
	26	39	*Mare Crisium* begins to emerge.
	28	38	Half emerged.
	31	51	Entirely emerged.
	38	0	The total emersion.

The observations were made with a telescope nine *Roman* feet in length, the sky without clouds but somewhat foggy: The moon's horizontal diameter taken at $15^h\ 46'$ intercepted 2934 parts of the micrometer, whereof her vertical diameter contain'd 2877; but the sun's diameter was observ'd the day before to possess 2830 such Parts.

13	0	16	The total immersion.
14	38	24	The beginning of the emersion.
1	38	8	The *Mora*.
3	37	0	The duration of the eclipse.

Omitting the refraction of the Sun at noon, the tangents in the gnomon (the horizontal diameter of whose aperture was $\frac{70}{100000}$) were

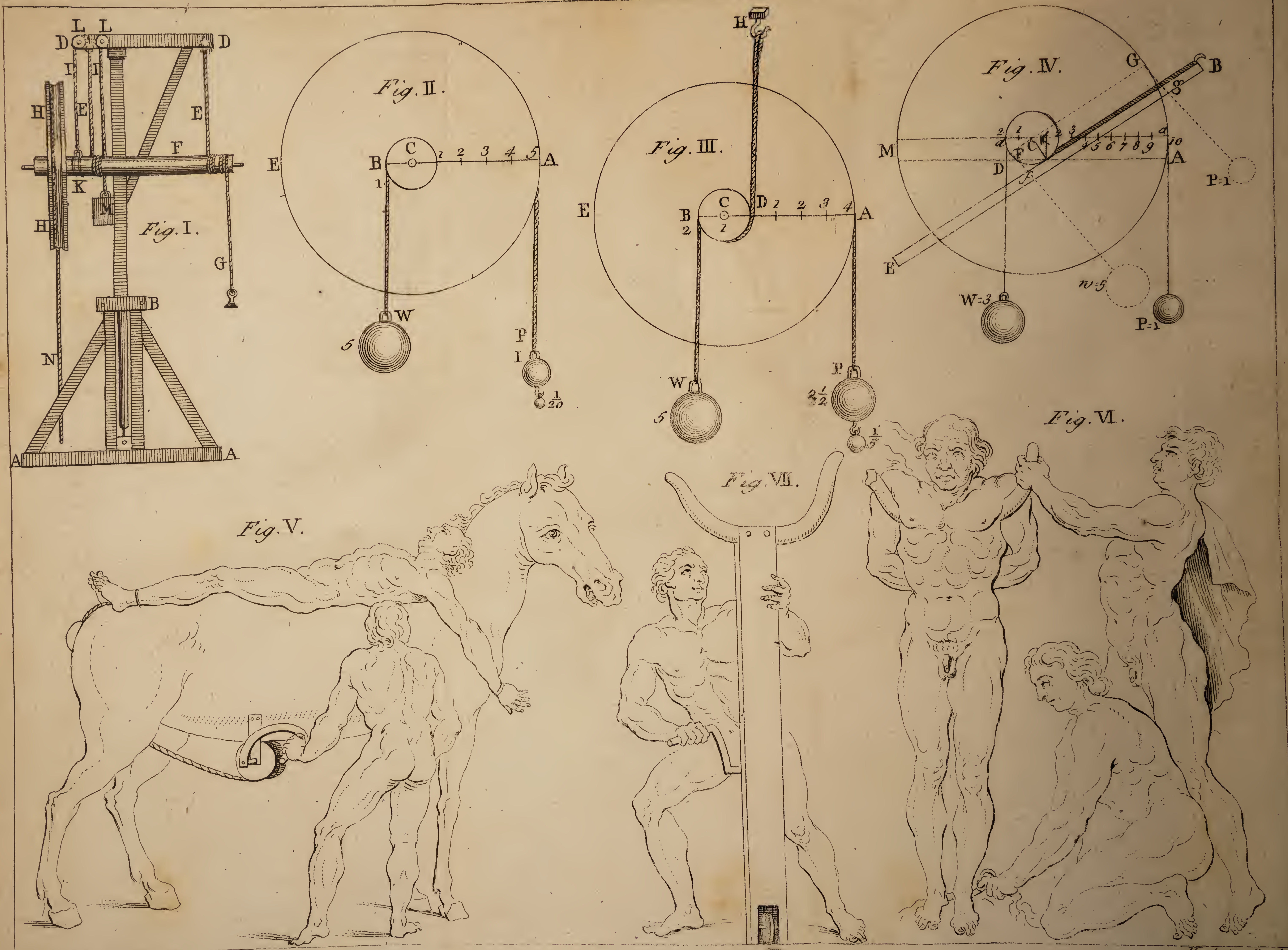
Aug. 7. { 48190, 47040

Aug. 8. { 48801, 47731

An examination of M. Perault's *new invented axis in* Peritrochio, *said to be entirely free of friction. By Dr.* Desaguliers. Phil. Transf. N°. 412. p. 222.

M. *Perault's* account of his engine is as follows: 'In imitation of the (modern) crane, I have invented two 'engines for raising weights: The first is made of that organ 'which is the most advantageous of any in mechanics, for facilitating motion; because it is free from that inconveniency, 'which we meet with in all others, namely, the friction of 'the parts of the machine, which renders their motion more 'difficult. This organ is the roller, which *Aristotle* prefers 'to all other organs; because all the others, as wheels, capstanes, and pullies, must necessarily rub in some of their parts: 'But

PLATE. I.



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'But the difficulty was to apply the roller to an engine that 'raises weights; its use having only been hitherto to cause 'them to roll on a horizontal plane. The engine which I pro-'pose has a base A A B (Fig. 1. Pl. 1.) something like the 'crane: This base has in its upper part the horizontal piece 'B, which clasps an upright shaft C O, supported under its 'pivot C, on which the whole engine moves in the same 'manner, as the crane, when the weight is to be lower'd. This 'shaft supports on it's top a cross piece D D, to which are fa-'stened the ropes. E E, which wrap around the barrel, axle, 'or roller F, which has another rope G, that likewise wraps 'or winds round one of its ends; this last rope is that which 'raises the weight: At the other end of the axle there is a 'large wooden wheel like a pully H H, about which is wound 'a long rope N.

'To work this engine, one must pull the long rope N, which 'causing the large wheel to turn, does likewise carry round 'the axle or barrel, which is made fast to it. This axle as it 'turns round, causes the ropes E E to wind about it; and 'thereby the axle and the wheel rise, whilst the rope E, 'to which the weight is fasten'd, does also wind itself up 'upon the axle the contrary way; and this double winding up 'of the ropes, makes both the burden and the axle and wheel 'to rise at the same Time. Now it is evident that all this 'rise is performed without the friction of any part; and con-'sequently, the whole power, which draws the rope N, is em-'ploy'd without any hindrance; which cannot be in other 'engines.

'It may be objected, that the power which acts at N must 'besides the weight, likewise raise the axle and large wheel; 'and that their weight is one of those obstacles which *Aristotle* 'says all engines are liable to, and that this obstacle is equiva-'lent to the friction, which is in other organs. But it may be 'answer'd, that friction which is an obstacle wholly unavoidable 'in all other organs, but that it is easy to remedy the obstacles 'of this, which is done by means of a heavy body M, taken 'equal in weight to the great wheel and axle, which it sus-'tains by means of the rope I I, which running over the 'pullies L L, is fix'd to the ring or collar K, that goes round 'the axle F: For, the axle and wheel being counterpois'd by 'this weight, the power, which acts by drawing the long rope 'N, acts in order to raise the weight only. The experiment, 'which was made with this engine, has confirmed the truth 'of this problem, by comparing its effects with those of the 'crane, in which the proportion of the bigness of the axle, 'to the circumference of the wheel, was the same as in my 'machine: For, it happened that in the crane the weight of 'one hanging at a rope going about the wheel, drew up a 'weight of 7, when it had one half added to it to make it 'proponderate, or give motion to the power: And when the 'weight to be rais'd, and that which serv'd as a power, were 'proportionably increas'd, there was also a necessity to increase 'the additional weight, which made the power proponderate 'in the same proportion: So that it was requir'd to add one 'half to the power, when the weight was seven; the addition 'to the power became one for a fourteen pound weight; two 'for a 28 pound, four for a 56, and so on; because the resis-'tence from friction increases nearly in the same proportion, 'that the weights are decreas'd. But this did not happen to 'any engine, in which one quarter was always sufficient for the 'draught (or to make the power preponderate) not only when 'the weight was seven, but likewise when it was 14 pound, '56 pound, *&c.* which evidently shews that this engine acts 'without friction.'

Thus far M. *Perault*. But however plausible this description may appear, a little attention will shew, that if this new engine had no friction, yet it is more inconvenient than an *axis in peritrochio* with the same proportions; and likewise that it has more friction than the same machine in the common use. A C E (Fig. 2.) represents a common *axis in peritrochio*, which has the wheel A E five times bigger in diameter than the axle: So that A C, the radius of the wheel (which is the distance of the power) is to C B the radius of the axle (the distance of the weight) as 5 to 1; consequently 1 (for instance, one ounce, as in our experiment) will keep five *in æquilibrio.* Now the friction of the gudgeon at C is unavoidable, yet it may be diminish'd, by diminishing the diameter of the gudgeon, provided it remain strong enough to sustain the machine and its burden. Here one pennyweight, or $\frac{1}{20}$ of the power added to it, makes it preponderate, and give the machine motion with a due velocity.

Now this very engine, made use of in M. *Perault*'s way, alters the distances of the weight and power in such a manner, that instead of one for our power, we must have two and a half to keep the very same weight 5, *in æquilibrio*, as may appear by Fig. 3. where, since in the action of the machine, when

when we pull the rope PA, we make the axle D B to wind itſelf up upon the rope HD; it is evident that D is now become the center of motion, DB (the whole thickneſs of the axis) the diſtance of the wheel = 2; and the diſtance of the power is reduced to AD = 4. So that if two men, having been employ'd in the common way to raiſe weights, equal to the ſtrength of ten men, an engineer ſhould after the manner of working, and fit up the axis *in peritrochio* in M. *Perault's* way, inſtead of gaining an advantage, he muſt call in three more men to perform the work: If it be anſwer'd, that what is loſt in ſtrength, will be gain'd in time; it may not only be ſaid, that one cannot always call in more help on the ſudden; but that even then, tho' we ſhould not call this an inconveniency, yet there will be ſtill more friction in this than in the common method; for the roller or axle will find a difficulty to wind up the ropes, becauſe they are not perfectly pliable; and the leſs ſo, the greater the weight is that ſtretches them. This, together with the friction of the collar of the rope of the counterpoiſe to the engine, makes the hindrance greater than in the common way. For, it appears by experiment, that when the power is become equal to 2 and $\frac{1}{2}$ to keep the weight 5 *in æquilibrio*, there muſt be added $\frac{1}{5}$ (here four penny weight) to put the power in motion.

And to ſhew that this friction of the ropes is not always the ſame, as M. *Perault* ſuppoſes it; when P (or the power) is made only one ounce, and W (or the weight) two ounces, then to make the power preponderate, only two penny-weight and 18 grains was ſufficient.

N. B. When P is = 2 and $\frac{1}{2}$, and W = 5; the additional weight, mark'd $\frac{1}{5}$, was four penny-weight and two grains.

A farther Examination of M. Perault's *Machine, ſaid to be without Friction; by the ſame.* Phil. Tranſ. N° 402. p. 228.

IN every inclination of the plane; if the ſine of the angle of inclination be taken in parts of the radius of the axle, or roller, the power : will be to the weight : : as the radius of the roller + the ſine of inclination : to the radius of the wheel — the ſaid ſine of inclination; that is, P (= 1) : W (= 3) : : $dk : ak$.

In the preſent experiment B E (Fig. 4. Plate 1.) repreſents an inclined plane, on which the roller C is to roll up, touching the ſaid plane at the point c; A M the wheel behind that plane;

plane; another ſuch plane, and equally inclined, being alſo ſuppos'd behind the wheel to ſupport the other end of the roller.

The lines of direction of the power and weight being aP and dW, thro' the point of contact, or centre of motion, c draws A D parallel to the horizon, and perpendicular to aP and dW; thro' the centre of the engine, C draws ad parallel to A D. Suppoſe the angle BcA of the inclination of the plane to be 30°, the right ſine will then be equal half the radius; therefore, dividing C 2 (the radius of the roller) into two equal parts at k; if you draw kc and Cc, the angle kcC will be equal to BcA, and its ſine will be Ck. Now ſince it is evidently the ſame thing to make uſe of ad for a lever, whoſe centre of motion is at k, as of A D, equal and parallel to it, with its centre of motion at c; it follows, that in this inclination of the plane, the diſtance of the weight dk is greater than dC (the diſtance of the weight in the common uſe of this engine) by the addition of the quantity Ck, the ſine of the angle of inclination; and ka the diſtance of the power is leſs than Ca (the diſtance of the power in the common way) by the ſubſtraction of the ſaid quantity, or ſine Ck; conſequently, that on an inclined plane, the power : is to the weight : : as Dc : to c A. Q. E. D.

Corollary 1. Hence it follows, that the radius of the wheel, and the radius of the roller being given, the loſs of power may be found in any inclination of the plane. Thus, as here, the power, which in the common way would be but $\frac{1}{5}$ of the weight, muſt be $\frac{1}{3}$ of it: So if the angle of the inclination of the plane were but 11° 32′, the power would be $\frac{1}{4}$ of the weight, &c.

Cor. 2. Hence it likewiſe follows, that if the plane B E be horizontal, no force of the power will be loſt; becauſe cg : : cf : : C G : to C F.

Scholium. As the friction of the winding of the ropes, ſuch as Bc in the new way, is greater than the friction of the pivot in the old way (beſides the friction of the collars of the counterpoiſe to the engine) ſo that friction diminiſhes, as the rope bears leſs weight, according to the diminution of the angle of the plane; and when the plane is horizontal, and without a counterpoiſe; even then the winding up of the ropes, and preſſure of the roller againſt the plane, is equal to the friction in the common way.

N. B.

N. B. The experiment is made here with pivots 12 times lefs in diameter than the roller, and fine pliable filk, inftead of ropes.

Of the Equuleus *or* Wooden Horfe *of the Ancients; by Mr.* John Ward. Phil. Tranf. N° 412. p. 231. *Tranflated from the* Latin.

FOR what end the *Equuleus* or wooden horfe was firft inftituted, and to what ufe it was applied is pretty evident from feveral paffages in ancient authors. But fince none of them hath defcrib'd its figure and the manner of conftructing it; learned men have run into various opinions and thofe widely differing from each other. Nor, indeed will this feem furprifing to any one who confiders, how difficult very often it is to determine ought with certainty about things that have been in difufe for feveral ages, and removed from our view; efpecially, if the ancient authors, who mention them, do it only flightly, and do not fully defcribe them. This, as has been faid, was the cafe with the *Equuleus*, nor did any of the learned, who after the revival of literature undertook to defcribe this machine, feem to Mr. *Ward* to have done it with fuch fuccefs, as that their defcription agreed in every refpect with what the ancients deliver about it: So that he had entirely laid afide all hopes of obtaining any greater certainty in this affair: But being favoured with the fight of fome papers fent Dr. *Mead* from *Rome*, in which were delineated feveral figures of an ancient work, ftill extant there; amongft others he happened to light upon one, drawn from a marble, in the Prince of *Burgefi's* palace, which, as he conjectured, reprefented a man fufpended on the *Equuleus*: And upon more attentively confidering the matter and more carefully enquiring into the paffages in ancient authors, where mention is made of the *Equuleus*, and diligently comparing them with this figure; he plainly difcover'd not only the miftakes of modern writers on that head, but as he thought, the caufes of their miftakes; as fhall manifeftly appear from what he is to fay of this ancient machine.

Equuleus, therefore if we attend to the etymon of the word, fignifies *a horfe colt*, or *little horfe*, as we find from the following words of *Tully de nat. Deor. l.* 2. *c.* 14. *Chrifippus omnia in perfectis & maturis docet effe meliora; ut in equo, quam in equuleo:* And hence the machine we are treating of, firft took both its figure and name.

Some

Some have erroneoufly confounded the *equuleus* with the *crux* or *crofs*; but this latter was a kind of gibbet, to which flaves and others of mean condition were affixed and punifhed with death; but on the *equuleus* the torture was applied in order to extort confeffion: Thus *Valerius Maximus*, lib. 8. cap. 4. makes mention of a certain flave, who, tho' tortur'd fix times on the *equuleus*, denied the fact, and yet was afterwards condemn'd by the judges, and crucified: The *equuleus*, therefore, either as to form or ufe, did not agree with the crofs.

But amongft the various opinions, Mr. *Ward* felects only two, as coming neareft the truth. The one, that of *Hieronymus magius de Equul.* c. 1. (whom *Gallonius de S. S. Martyrum cruciat. cap.* 3. follows) who rightly judged it to have been made *in the fhape of a horfe.* The other, that of *Caracciolus*, *apud Ferrar. Elect. l.* 1. *c.* 5. who, no lefs rightly, judged it to have been an *erect ftake.* Now Mr. *Ward* endeavours to fhew, that both were miftaken (not to mention other errors) in imagining that there *quuleus* was always of the fame form.

In the more early times the *equuleus* was in fome meafure made like a horfe, with its back flatted and of fuch length and breadth, as that a man's body might be conveniently extended thereon: And he who was to be tortur'd, did not fit, but lay on his back with his arms writhed back under the *equuleus*'s breaft, his hands bound and feet extended: The *equuleus* was provided with two pullies of different fizes; the leffer placed between the buttocks, made hollow to receive it; and the larger, with a handle to it, under the belly. The executioner after tying both feet with cords (call'd *fidiculæ*) paffed the cords over the leffer pully, and faften'd them to the larger one; which laft as he turned round with the handle, he could ftretch the body, till all the joints were loofened, and that with the moft exquifite pain.

In the next place Mr. *Ward* produces the teftimonies of ancient authors, that may confirm this defcription. The very name (as has been obferv'd above) feems pretty plainly to fhew that the *equuleus* was fhap'd like a horfe; as there is at this day among us, fuch another fort of machine for military punifhments call'd the *wooden horfe:* And the fame thing is manifeft from thofe modes of fpeech, borrow'd from the horfe and applied to the *equuleus*: Thus in *Cicero Tufc. Quæft l.* 5. *c.* 5. we read not only *conjici*, *& imponi*, but likewife *ire in equuleum.* And hence *Pomponius*'s jeft in the Atellanic verfes, *Apud. Non. in voc*, tolutim,

At

——*At ubi insilui in cochleatum equuleum,*
Ibi tolutim tortor.

Where the poet has evidently borrow'd the words *insilui* and *tolutim* from horsmanship: Besides, when he says *cochleatum*, which Mr. *Ward* would rather read *trochleatum equuleum*, he shews that it was provided with *screws* or *pullies*. And *Seneca* informs us that men were wont to lie along upon the *equuleus*, when he says *Epist. 66. Hoc nobis persuadere conaris, nihil interesse, utrum aliquis in gaudio sit, an in equuleo jaceat.* And that the body was stretch'd with small cords, *Fabius Declam.* 19. testifies, where a father accus'd for torturing his son to death, speaks thus: *An tu quæstionem illam fuisse credis, qualis vernilibus corporibus adhibetur? ideo enim equuleum movebam artifex senex, tendebam fidiculas ratione sævitiæ, ut leniter sedibus suis emota compago per singulos artus membra luxaret.* Whence also *Seneca* says *Epist.* 67. *hominem fieri longiorem in equuleo:* And as for that reason the hands and feet must needs have been tied down; so it shall be shewn anon, that that was done, in the manner, already mentioned. What is said of *Zeno* the philosopher, *Val. Max. l.* 3. *c.* 3. Seems to agree very well with this description of the *equuleus*. *Is enim cum a Nearcho tyranno torqueretur, doloris victor, sed ultionis cupidus, esse dixit quod eum secreto audire admodum expediret; laxatoque equuleo, postquam insidiis opportunum tempus animadvertit, aurem ejus morsu corripuit, nec ante dimisit, quam & ipse vitâ, & ille corporis parte privaretur.* Now a man, lying upon the *equuleus*, as has been explain'd above, was at such a distance from the ground, that one might conveniently enough apply his ear to the other's mouth; and consequently, when the executioner slacken'd the cords, by gathering up his feet a little and bending his head, he might easily lay hold of his ear with his teeth.

It moreover seems probable, that the brazen bull, which *Perillus* made, and presented to *Phalaris*, took its rise from hence. For, *Plutarch Parall. c.* 39. *and Ælian Var. hist. l.* 2. *c.* 4. testify that men were wont στρεβλοῦσθαι by that cruel tyrant; by which word as *Ælian* himself elsewhere, *apud Suid. in voce* στρεβλούμενος shews he meant *equulei extensionem.* And thus in *Philoxenus*'s *Glossary* στρεβλωτης. signifies *equuleus.* when, therefore, *Perillus* that ingenious artist at mischief, had observ'd that persons, tortur'd on the *equuleus*, did by their groans and cries make a noise, not unlike the bellowing of a bull; it may not seem absurd, that in order to make the reſemblance as near as poſſible, he firſt bethought himſelf of changing the figure of the horſe into that of a bull, and of ſhutting men up therein.

The *equuleus* as had been ſaid, had not always the form of a horſe; but in latter ages was changed into a quite different one; but tho' it changed it's figure, it ſtill retain'd the name, a thing not uncommon: For, not to mention other inſtances, that warlike engine, which from its reſemblance, to a ram's head, was call'd *Aries*, had not always the form, from which it originally took its name. *Vide Lipſ. Poliorcet. lib.* 3. *dial.* 1.

The *equuleus*, therefore, in theſe days was an erect ſtake, a top of which lay a croſs piece of timber, incurvated at both ends like horns; and provided as the former, with two pullies; the leſſer of which was fixt into the lower part of the ſtake, made hollow to receive it; the larger had a handle to it, and was faſten'd behind: The perſon to be tortur'd, being rais'd upon the *equuleus*, hung with his arms bent back on the croſs piece of timber, and with his hands bound behind him to the ſtake; his feet were alſo tied with cords, which, paſſing over the leſſer pully, were received into the larger one fixt to the back part of the *equuleus* by turning of which round, the body was ſtretch'd.

And ſince eccleſiaſtical writers, who give an account of the exquiſite tortures of the martyrs under the *Roman* emperors, make frequent mention of this ſort of *equuleus*; their teſtimonies are of eſpecial uſe in proving its figure.

Amongſt others S. *Jerom Epiſt. ad Innoc.* 49. calls it *Stipes* a ſtake; as alſo *Prudentius* περι στεφ; Hymn. 10. v. 114.

Jubet amoveri noxialem ſtipitem.

And that it was in an erect poſition appears hence, that the patients were ſaid *ſuſpendi & pendere in illo*; as ſhall be ſhewn anon from *Euſebius* and *Prudentius.*

Mr. *Ward* finds no mention made in ancient authors of the croſs piece of timber; and this we may reaſonably ſuppoſe, gave occaſion to the ſeveral errors of the learned in deſcribing this machine. But in the fig. to be deſcribed anon, that piece of timber, incurvated like a pair of horns, is plainly to be ſeen. And that it was likewiſe provided with pullies, may be gather'd from the following words of *Euſebius, Hiſt. Eccleſ. l.* 8. *c.* 10. *Quidam, manibus poſt tergum revinctis, ad ſtipitem ſuſpendebantur, ac membrum unum quodque μαγγανοις quibuſdam diſtendebantur.* Where the term μαγγανοις (uſed in the plural number) and which agrees almoſt to any machine provided

provided with ropes and a handle, ſeems to ſignify pullies: And as *Euſebius* informs us that their hands were tied behind; ſo *Prudentius ubi ſupra hymn.* 5. *v.* 109. that their arms were turned back, when he brings in the judge paſſing ſentence in the following words.

Vinctum retortis brachiis
Surſum ac deorſum extendite,
Compago donec oſſium
Divulſa membratim crepet.

That the feet were likewiſe wont to be tied, appears from the ſame poet, *ibid hymn.* 10. *v.* 491. where the martyr ſpeaks thus from the *equuleus.*

Miſerum putatis quod retortis pendeo
Extentus ulnis, quod revelluntur pedes.

But in order to pull back the feet, they muſt firſt be tied down: And from both writers it appears, that it was an erect ſtake. And hence the judge orders the body to be ſtretch'd up and down at the ſame time: For, in this poſition of the body, by pulling back the feet the inferior parts would be ſtretch'd downwards; and the ſhoulders, ſupported by the croſs piece of timber, and repreſs'd by tying his hands to the ſtake, muſt neceſſarily be puſh'd upwards and luxated. And becauſe they hung aloft from the ground, hence the judge (vide *Sozomenus Hiſt. Eccleſ.* l. 5. c. 2.) orders a Chriſtian ἀιωρεῖσθαι, *i. e.* to be raiſed or hoiſted aloft on the *equuleus*: Nay, that the puniſhment might be the more conſpicuous according to *Ferrarius Elect.* l. 1. c. 6. the *equulei* were placed upon the *Cataſta*; of which, he obſerves, may be underſtood the words of the martyr; *ubi ſupra hymn.* 10. v. 467.

Emitto vocem decataſta celſior.

To which Mr. *Ward* thinks may be added, the following words in *v.* 108. of the ſame hymn.

Incenſus his Aſclepiades juſſerat
Eviſcerandum corpus equuleo eminus
Pendere.

The *Catasta* is a wooden frame or scaffold, answering to our *pillory*. *Ferrarius de judic.* lib. 3. c. 17. therefore, thinks that *Sigonius*, and other learned men, are mistaken in taking the *catasta* for the *equuleus* itself. And indeed, were not the *equuleus* placed upon a *catasta*, how could the executioner with his iron *ungulæ* eviscerate the body hanging aloft thereon? And we learn from *Justinian*'s *Code L. 16. de quæst.* that small cords were made use of equally in this form of the *equuleus*, as in the former; where by an edict of the emperor *Valentinian* it is enacted *Decuriones exsortes omnino esse earum pœnarum, quas fidiculæ & tormenta constituunt.* For, it is very well known, that the ancients by these words (*fidiculæ & tormenta*) frequently describe the *equuleus*.

Now, if we consider a little more attentively the words and phrases, made use of at different times in speaking of the *equuleus*, we must needs acknowledge that they by no means agree to the same form thereof. For, first we may gather that its form was changed from the new name super-added to it, the term *stipes* by no means agreeing to a machine, made in the shape of a horse: Wherefore, we must conclude, either that it never was in the shape of a horse, contrary to the certain meaning of the word *equuleus*, and modes of speech borrow'd from it; or that, when it afterwards began to be called *stipes*, it had another form: Besides, men were said in ancient times *jacere*; but afterwards *pendere* and *suspendi in equuleo*; both which postures of the body, so widely different, require the form of the machine to be no less so. Add to this, that different effects seem to be ascribed to the different forms. For, in the more ancient times the body is simply said *extendi*, as being laid along; but in after ages it is ordered to be *sursum & deorsum*, which agrees to a pendulous posture. In fine, a man lying upon the former *equuleus* was at such a height, as that he could whisper another in the ear; but this can by no means agree to one hanging in the latter, by reason of the too great distance from the ground. So that this difference of words and phraseology is necessarily to be referred to two different kinds of *equuleus*: And those learned men, who have been of a different opinion, whilst they endeavoured to accommodate to their own nations the different phrases used by the ancients on this matter, have been involved in difficulties from which they could by no means extricate themselves.

But to remove all manner of doubt for the future, Mr. *Ward* briefly considers two testimonies, adduced by *Gallonius de S. S.*

Martyr.

Martyr. cruciat. c. 3. from thoſe times, in which the *equuleus* was ſhewn to be in the form of a *ſtake* : One is from the following words of S. *Jerom*, *Epiſt. ad Innocent.* 49. *cum equuleus corpus extenderet, & manus poſt tergum vincula cohiberent, oculis, quos tantum, tortor alligare non poterat, ſuſpexit ad cœlum.* From which paſſage *Gallonius* contends, that the patient lay proſtrate upon the *equuleus*. But it is plain, that a man, hanging in the manner mentioned, might as eaſily look up to heaven, as if he lay on his back. The other teſtimony is from *Ammianus Marcellinus* l. 26. c. ult. *Innocentes tortoribus expoſuit multos, vel ſub equuleo cepit* (or rather according to Valeſius *caput*) *incurvos, aut ictu carnificis torvi ſubſtravit*, and elſewhere; lib. 28. c. 1. *quanquam incurvus ſub equuleo ſtaret.* Whence the ſame learned man has invented a new and unheard of kind of torture; as if the executioners, in order to heighten the pain, ſlackened the cords, and thereby ſuffered the body to fall down under the belly of the *equuleus*, and there hang in an incurvated poſture. But *Ammianus* does not ſay, *ſub equuleo cecidiſſe* or *pependiſſe*, but *ſtetiſſe*; which how it can agree with *Gallonius*'s opinion, Mr. *Ward* does not ſee. But as it was cuſtomary firſt to ſcourge ſuch as were to be tortur'd on the *equuleus*, ſo he probably uſed the term (*incurvus*) becauſe the patient could not ſtand upright under that puniſhment; and *ſub equuleo* ſignifies, *juxta equuleum*; in the ſame ſenſe as *ſub haſtâ venire* Liv. l. 5. c. 16 and the ſame may be ſaid of the word (*incurvos*) in the other paſſage of *Ammianus*. Unleſs one would rather take theſe words to mean thoſe loaded with chains, and conſequently incurvated or bent under their weight; as *Paulinus Aquitanus de vit. B. Martini* l. 5. v. 261. writes in a like caſe.

> Mœſtorum pallens infelix ordo reorum
> Hœrebat, nexis per ſquallida colla catenis,
> Incutiens fractis ſtridentia vincula membris,
> Et motans tardos, incurvo pectore, greſſus.

Here the poet ſeems to take the words (*incurvo pectore*) in the ſame ſenſe, as *Ammianus* (*caput incurvos.*) And a few lines after he likewiſe ſays, that ſome of theſe unhappy wretches were deſtined to the *equuleus*.

Ast alii sursum porrecti robora ligni,
Triste ministerium, furioso corde parabant;
Ut caro distentis properè, male pendula, membris
Tortori laceros crucianda exponeret artus.

Where likewise the words (*sursum porrecti robora ligni, & caro pendula*) plainly shew the erect form of the *equuleus.*

Moreover, when a confession could not be extorted either by scourging or extension of the limbs, in the more early ages they applied fire and glowing hot plates to the body. Thus *Fabius Declam.* 7. reciting the whole affair in order; *ego scindo vestes, tu intremiscis; ego ad flagella nudo corpus, te facit pallor exanimem: ego posco flammas; tu non habes in meo dolore patientiam.* And *Valerius maximus* l. 3. c. 3. *rupit verbera, fidiculas laxavit, solvit equuleum, laminas extinxit; priusquam efficere potuit, ut tyrannicidii socios indicaret.* But in after ages, when the *equuleus* was in the form of a *stipes*; to all these methods of torture were also added the iron *ungulæ* or claws, with which the sides and other parts of the body were wont to be torn. Thus it is adjudged in the *Codex Justin.* l. 7. *de malefic. Si convictus fuerit, & ad proprium facinus detegentibus repugnaverit pernegando, sit equuleo deditus, ungulisque sulcantibus latera perferat pœnas proprio dignas facinore.*

Yet Mr. *Ward* cannot positively affirm at what time this change of form in the *equuleus* began among the *Romans.* That it retained the form of a horse, at least to *Fabius*'s time, that is, under the emperor *Domitian*, seems the more credible; because the father, who, in *Declam. supra citat.* pleading in his own defence for torturing his son to death, describes him as in a lying posture. And Mr. *Ward* thinks, a pretty probable reason for the change may be given: For, in the latter ages of the *Roman* empire we often read, that not only Christians, but likewise other persons of considerable rank and dignity, accus'd of treason, were condemned to the *equuleus.* But as long as it was only applied in extorting confessions, nothing more was necessary, than that the judges, and others concerned, should hear what was said; for which purpose the form of a horse was a pretty convenient one: But afterwards when this machine was abus'd by cruel tyrants, to indulge their suspicions and to torment Christians, an erect form, undoubtedly, was the most proper. For, thus it in some measure resembled a cross, that the ignominy of the punishment might be the greater; and besides, the patient was more expos'd to the view of the beholders, in order to deter others.

It

It is true, that both the bull of *Perillus*, and the abovementioned hiſtory of *Zeno* ſeem to ſhew pretty evidently, that the figure of a horſe was in uſe among the *Greeks*, from whom the *Romans* borrowed it.

But that the difference between theſe two machines may the more plainly appear, and that they may be the better compar'd together; Fig. 5. Plate I. repreſents the former *equuleus* and Fig. 6. the latter. At the former ſtands the executioner, holding the handle of the larger pully, in order to ſtretch the patient laid along on the back of the *equuleus*. The latter, which was delineated from Dr. *Mead*'s figure, repreſents three men; one of which hangs on the *equuleus*, the other two are executioners: One of theſe has a *chlamys*, (a garment *S. Jerom ubi ſupra* likewiſe gives the executioner) thrown behind from his left ſhoulder, and with his right hand he takes hold of the right horn of the *equuleus*, as if he were to ſet ſomething to rights; the other, as aſſiſtant to the former, naked, and on his knees, prepares himſelf to tie the feet of the patient. That the left horn of the *equuleus* is ſhorter than the right, Mr. *Ward* thinks is owing to the injury of time; becauſe the extremity plainly appears to have been broken off. Either the artiſt or at leaſt the deſigner has omitted ſome things; for, neither is the lower part of the *ſtipes* to be ſeen (where it ought to be) nor the lower pully; the other pully, as was obſerved, being wont to be placed behind: But in this, either the one or the other has evidently been miſtaken, in placing the man on the *equuleus* in ſuch a manner, that he ſeems to touch the ground with his toes; which does not at all agree either to a pendulous poſture, or to the abovementioned teſtimonies of the ancients on this matter. But we frequently find this to be the caſe in ſuch ancient monuments, namely, that the artiſts content themſelves with repreſenting very carefully the principal and eſſential parts, either entirely neglecting the others, or at leaſt expreſſing them leſs accurately. But to ſupply that defect Mr. *Ward* has added Fig. 7. where the executioner turns the pully: The arch to the left has no concern with the *equuleus*; but exhibits a part of ſome door, probably of the priſon, whence the patient was taken out.

Now if we compare together both theſe forms of the *equuleus*, and their ſeveral parts, we ſhall eaſily ſee the ſame method of torture under different forms: For if we ſuppoſe that the former, made in the ſhape of a horſe, was raiſed aloft; the pullies, the ropes, the retorſion of the arms, and the extenſion

of

of the whole body will appear the ſame as in the latter; and we ſhall have an eaſy and expeditious method of torture; a thing chiefly requiſite in public puniſhments.

But leſt any one ſhould ſtill imagine, that Mr. *Ward* has given an account of the *furca*, that is, a *croſs*, made like a *furca*, inſtead of the *equuleus*; it is to be noted, that this form of the *equuleus* was not very unlike the *furca*; which is evident from the words of one *Theophilus*, adduced by *Gallonius*, plainly againſt his own opinion: *Ecce*, inquit, *modo Chriſtianus ſum, quia in cruce, id eſt, in equuleo, ſuſpenſus ſum: Equuleus enim crucis quandam ſimilitudinem gerit.* vide *de S. S. Martyr. cruciat.* c. 3. and yet the *furca* differed from the *equuleus* in ſeveral reſpects: For, firſt, the loweſt part of the horns terminated in a point like the letter V; and then the horns were much longer: Beſides, the perſon on the *furca* hung with his arms turned back above his head, and not behind his back; in fine, his hands were not tied to the *ſtipes*, but extended on the horns and faſtened thereto, as *Lipſius de cruce* l. 3. c. 6. ſhews. And yet the ſame learned Gentleman *ibid. l.* 1. *c.* 5. referrs to the *croſs* the words of Auſonius *de Cupidine torto*, which, undoubtedly, ought to be referred to the *equuleus*. The paſſage of *Auſonius* is as follows.

> *Hujus in excelſo ſuſpenſum ſtipite amorem,*
> *Devinctum poſt terga manus, ſubſtrictaque plantis*
> *Vincula mœrentem, nullo moderamine pœnæ*
> *Adfligunt. Idyll.* 6.

And when the poet ſays here, *devinctum poſt terga manus*, he plainly deſcribes the *equuleus* not the croſs. Moreover when *Sulpicius Severus*, ſpeaking of S. *Martin*, ſays that he affected the glory of a martyr ſo much, that, if he might be allow'd *he would voluntarily mount up the* equuleus Epiſt. 2. And both the figure of the machine, and manner of ſuſpenſion evidently ſhew how it could be done: But no ſuch thing could happen on the *furca*.

Upon the whole then, ſince the entire proof of this matter chiefly depends on the teſtimonies of ancient writers, and as Mr. *Ward* thought it ſuperfluous to adduce any more, tho' very numerous; ſo he was of opinion that fewer would not be ſufficient to explain it fully. But whatever accounts the ancients give us on this head, they may eaſily be referred to one or other ſpecies above deſcribed. One, therefore, who attends to the

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age of the author, the different modes of ſpeaking uſed at different times, can, Mr. *Ward* thinks, find no difficulty for the future, what he ought to determine about this kind of torture; in explaining which ſo many learned men have hitherto perplexed themſelves to no purpoſe.

Meteorological and Aſtronomical Obſervations for the Years 1728, 1729, *&c. at* Wittemberg; *by M.* Weidler. Phil. Tranſ. N° 412. p. 250.

THE firſt meteorological obſervation M. *Weilder* takes notice of is a remarkable halo round the moon, on *Feb.* 20. 1728, at 45 minutes paſt 7 in the evening; when the moon was not far diſtant from the meridian, and about her firſt quarter. The diameter of the halo poſſeſſed about 47 degrees, reaching from ϐ in *Procyon* to *Capella* towards the weſt. Its arch was 4 degrees and ½ broad, as far, for inſtance, as α and ϐ in *Procyon* are from each other. In the inſide it was red, and towards the extremity pale; exhibiting entire a beautiful *ſpectrum* for about 4 minutes; but he did not know when it began. Before it diſpers'd, ſome thin white clouds began to paſs over it tranſverſely, and then it was broke towards the weſt, the redneſs of the diſperſing vapours greatly increaſing: After which the ſky became clear again. The ſame day at noon he obſerved 13 ſpots on the ſun; the largeſt being equal to $\frac{1}{34}$ of the ſun's diameter; and the ſpirit of wine fell to 90 degrees of the *Engliſh* thermometer.

April 4. 1728, he obſerved an *aurora borealis.*

June 20. another, which is deſcribed in the *Act. Liter. Ann.* 1728. p. 375.

Oct. 7, a very remarkable one appeared in the N. E. a white arch, extended between the W. and N. E. quickly aſſumed a black colour, and then divided into three other concentrical arches equally black. From theſe ſome radiations aroſe as uſual, but ſhorter: A little after theſe likewiſe ceas'd; and the black arches were converted into luminous tracks; only one remained till 11 o'clock: And whereas at firſt the lowermoſt arch was raiſed 7 degrees above the horizon; it was now depreſſed towards it, being ſcarcely two degrees above it.

He next gives 14 aſtronomical obſervations; 10 of which are of the eclipſes of *Jupiter*'s ſatellites at different times. In making theſe he was guided by *Caſſini*'s tables for the meridian of *Paris*, and by comparing the time when they ſhould happen, as therein ſpecified, with the time he obſerved them at

Wittemberg, he collects the difference of meridians of that city and *Paris* to be 41 minutes.

The 8th. observation contains his *calculus* for the total eclipse of the moon, which happened *Feb.* 13. 1729, N. S. but the heavens being very cloudy, he could not observe the eclipse itself.

The 9. is an observation of mercury, *March* 4, 1729; at which time the planet was farthest from the sun, and continued some time above the horizon.

Making use, therefore, of a 22 foot telescope, he observed its phasis almost bissected; and its diameter appeared equal to a third part of the diameter of *Venus*, this planet being above the horizon, and seen at the same time.

The 13, is a conjunction of *Venus* and the moon, *viz.* *April* 2, 1729. At $7^h\ 13'$ he observed *Venus* placed in such a manner near the moon, that the horns of the latter were in the same right line with *Venus*, which was then distant from the southern cusp of the moon $1^\circ\ 10'$. At $7^h\ 30'$ he measur'd the distance of *Venus* from the eastern cusp of the *Pleiades* to be $2^\circ\ 15'$, and the horn of the moon at the same time was distant from the same cusp $1^\circ\ 53'$, the intermediate distance of the horns of the moon was $29'\ 30''$.

His last observation is on the declination of the magnetical needle in this, *viz.* 1730, and the former year, which he defines to be $12^\circ\ 0'\ 55''$ west at *Wittemberg* at this time.

These observations are followed by an account of the last hard winter, which set in sooner than usual, the rivers being frozen the 19. of *Sept.* tho' they did not use to be so till the winter solstice; and *Sept.* 21. the spirit of wine fell in the *English* thermometer to the 66. degree; at which time a N. E. wind blew very strong. Afterwards on *Oct.* 3. the spirit fell to 72°, and the ice was half an inch thick on standing waters in the fields: So that even then it might be judged, that the cold would be more severe than is usual in these parts. From this time the frost did not at all abate, but continued much in the same state the month of *October*, only on the 20. day, after a S. W. wind had blow'd pretty hard for some days, the cold was observed to increase remarkably. The beginning of *November* a strong E. wind continuing to blow for six days, the spirit fell to the 86. degree on the 5. and the ice was much thicker. On the 28. it fell to 96° after which they had no rain; but all vapours were congealed into ice and hoar-frost. On *Dec.* the 2. the spirit of wine stood at 96°

but on the 4. at 99°: So that it did not a little exceed the limit of intenſe cold. Hence a S. W. wind intervening now and then, the cold ſeemed to abate a little: But that, and ſometimes a N. E. wind blowing ſtronger on the 21, 22, 23. days, it ſo prepared the air, that on *Chriſtmaſs* day the ſpirit in the thermometer ſtood at 96°, and the cold was intenſe. Hence the winter grew immediately more ſevere. The wind almoſt always blew from the E. or N. So that on *January* 20. the cold was almoſt intolerable, on which day the ſpirit fell to the 126°, very little remaining above the ball of the tube; and this was the greateſt degree of cold at *Wittemberg*. After this the winter ſomewhat abated. A ſouth weſt wind blew freſh ſometimes; but afterwards a N. and E. wind reſtored the cold on *February* 3. when the ſpirit ſtood again at 86 degrees: On the 4. it fell to 95° and from this time, barring a few days, always in a morning it reciprocated between 80 and 100°, till *March* the 8. on which it exceeded 108°, and on the 9. it was forced down by a N. E. wind to 110°. But tho' the ſpring was at hand; yet the ſeverity of the weather did not ceaſe; as appears in that the ſpirit of wine in the *Engliſh* thermometer, in a morning always ſtood at, or under the 80°; nay even on *March* 21. on which day the equinox preciſely fell, it was at 81°. At length on the laſt day of *March*, the weather grew milder; from whence may be taken the true beginning of the ſpring; not but that all *April* was much colder than uſual.

After this the curious obſerver proceeds to ſhew its ſeverity from ſome of the moſt remarkable effects the cold had on the rivers, plants and animals. As to the firſt he ſays that the *Elbe*, both at *Wittemberg* and other places, was on *December* 29 covered with a perfect bridge of ice, which bore both men and all ſorts of carriages, This continued till *February* 28, when it grew thinner, and broke conſiderably: But the cold returning on *March* 8, it re-united, and was as firm as before, till *March* 29. The water within the houſes, and in the bed-chambers, where were kept good fires, was entirely congeal'd, and the rind on the inſide of the windows ſtuck for ſeveral days, when the wind was either E. or N. tho' the room were well warm'd. There were ſeveral examples of the other kinds. Many periſh'd in their journeys, and more loſt their limbs in a very ſhort time. So that near the *Elbe* they could not work abroad. It likewiſe kill'd ſeveral animals immediately. The crows, which can bear intenſe cold, fell dead from the trees: Stags, goats, and hares, periſh'd in great numbers. The plants in like manner felt its violence, and the more tender trees were damaged. The limes were every where injured. The larger branches of the plumb-trees, apricocks and peaches, were dried up: But the vines ſuffered moſt; the more robuſt being ſhrivell'd to the very loweſt part of their trunk, unleſs guarded by a wall or ſome other covering.

From theſe obſervations M. *Weidler* compares this winter with the memorable one of 1709, and proves both from thermoſcopical obſervations; from its effects on the earth and animals; from its longer continuance, and from the greater extent of the cold into the more ſouthern parts, that this latter much exceeded the former, at leaſt in *Germany*.

Laſtly, he enquires into the probable cauſes of it, he takes notice, that the preceeding winter was moderately cold and dry; and as a cold ſummer ſucceeded, and alike dry, in which the north winds blew moſt frequently, and during the hotteſt months of *July* and *Auguſt* the ſky was covered with dark and black clouds, the earth was prepared for froſt, to which the remarkable drineſs of the ſeaſon did not contribute a little, as barometrical experiments ſhew, that a dry air cools ſooner than a moiſt; and is both heavier and retains cold longer: Nor does he think it altogether foreign to truth; to reckon the remarkable frequency of the *aurora borealis* to be a preſage of a colder winter than ordinary, which has been obſerv'd to be followed by cool and ſerene weather: As alſo the unuſual number and largeneſs of the ſpots on the ſun's diſk, for almoſt two years together: By which means, in ſuch a length of time, the force of its rays might be obſtructed in ſome meaſure, and the colder winds thereby have liberty to prevail. The air by theſe concurrent cauſes being rendered very cold, the increaſe and extreme degree of it proceeded from the great coldneſs of the ſky, and the blowing of the N. E. or E. wind ſo remarkably obſervable for the moſt part of the froſt.

An Occultation of Venus *by the* Moon *at* Berlin September 19. *p. m. N. S. by M.* Kirch. Phil. Tranſ. Nº 412. p. 256. *Tranſlated from the* Latin.

THE approach of the moon to *Venus* happened at $2^h\ 2'\ 16''$. The total occultation was at $2^h\ 3'\ 1''$. With an eighteen foot teleſcope M. *Kirch* obſerv'd, that as ſoon

ſoon as *Venus*, placed almoſt in quadrature, approach'd the moon's diſk, ſhe changed her figure, and loſt her horns, and put on an oval or elliptic figure; which appearance M. *Kirch* thinks may ſerve to prove an atmoſphere about the moon.

A large Stone *in the* Urethra; *by Dr.* Huxham. Phil. Tranſ. N° 413. p. 257. *Tranſlated from the* Latin.

TWENTY years before one *Cookworthy* had his *Penis* cut off on a venereal account, but the cure was ill performed; for, after cicatriſing, there was ſcarce any paſſage left for the urine, the *urethra* being almoſt cloſed up: From that time the patient made water in a very ſmall ſtream, and with the ſtrongeſt efforts, and ſoon felt exquiſite pain in making it; not long after, there appear'd a ſmall tumour on the middle, but upper part of the *ſcrotum*, which gradually increaſing, at length grew to a prodigious ſize, inclining to the left groin; on which account being altogether uncapable of making water, it cauſed a continual drizzling: But yet he did not diſcharge the whole this way, the greateſt part of it being voided by three or four *fiſtulæ* in the *ſcrotum*, together with purulent matter at times: And yet the tumour now grown very hard, was ſo far from decreaſing, that it rather became bigger.

This patient was brought into the hoſpital, and ſome time after, ſtraining to make water, which, he ſaid, felt hotter than ordinary, and doubling his body very much, he voided a large ſtone, which, at the time, weigh'd five ounces and a half *Avoirdupois*. The lacerated *ſcrotum*, whoſe ſwelling now ſubſided, could eaſily admit a child's hand; and the Dr. found that the ſtone had paſſed out of the *urethra*, and what is perhaps, no leſs ſurpriſing, is that this large wound was ſoon healed, by only anointing it with ſome terebinthin balſam, ſave that there was a ſmall fiſtula for the urine on the upper part of the *ſcrotum*: And the patient, who before could hardly ſtir, now walk'd about pretty well.

The Dr. is far from thinking, that this ſtone was originally formed in the *urethra*; but rather increaſed there from a concretion of gravelly matter: For, probably, a ſmall *calculus*, the ſeed, as it were, of this huge ſtone, falling down from the kidneys, and from the ſtoppage of the *urethra*, denied any farther paſſage, ſtopt in this ſmall canal, and increaſing by the

the continual acceffion of gravel, at length grew to that prodigious fize.

An Account of the Imperial Salt-works *of* Sóowár *in* Upper Hungary; *by Dr.* Bruckman. Phil. Tranf. N° 413. p. 260.

Sóowár is an *Hungarian* word (which in *High Dutch* fignifies *Salt-burg)* compounded of *So*, *i. e.* falt, and *Wa*, which fignifies burg or town. It is a large village, about a quarter of a mile from *Eper*, a city of the county of *Sáar*, entirely peopled with officers of the excife, and miners, or wood-cutters; and fituated on the top of a little hill, with an agreeable profpect.

July 16, 1724, we came from *Rofenaw* to *Sóowár*, with Dr. *Poëkin*, in order to view this celebrated falt-work, which furnifhes the fineft and pureft falt of the whole kingdom. Having communicated our intention to an officer of the falt works, and afk'd his leave to go into the *Cuts*, he gave us two guards for guides. We firft went down with them into the well by a rope, feated on *leathern dogs* (as they call them) about 40 fathom deep; after which we again defcended 100 fathom, by holding ourfelves perpendicularly againft the walls and fides of the pits; and having again continued our journey under ground in the falt-work, we then found ourfelves in the *Cuts*, and faw all the *Allies*, cut out in the fineft rock-falt; in the midft of which there were here and there fome veins of flint of a dark grey colour. The miners work to cut this rock-falt, which they draw up by a rope, and put into a refervoir, where they cleanfe it with falt-water. Afterwards they boil it with the fame water, till it become of the confiftence of cryftal; and then they put it into veffels, which contain about 268 *lb* each; and then fend it into *Silefia* and other countries.

As to the vegetable or foffil falt, it is exceeding white and tranfparent; and in fuch plenty in the falt-works of the county of *Marmer* near *Tranfylvania*; where there are entire large mountains of it, that from them one might furnifh the whole world with falt; and again as you cut it, it foon grows anew: They break and cut it; and tho' at firft it appear black, yet in pounding, it becomes exceeding white; and fo it is with that which they ufe in *Hungary*, for, they export all the falt of *Sóowár* into foreign parts. There is fcarce an inn where you do not find two ftones like thofe made ufe

ufe of in making muftard, between which they pound and break that fort of rock-falt: And in their ftables one likewife finds large pieces of that mineral, for the cattle to lick at pleafure.

But to return to the falt of *Sóowár*: In the cuts one fometimes finds allies of rock-falt of the moft delicate blue and yellow colours. We obferv'd that the falt of the former colour, being expos'd to the fun for fome days, entirely loft all that beautiful ultra-marine, and became white like the other rock-falt; which did not happen to the yellow, it ftill retaining its colour: But when both are pounded together, the falt is neither blue nor yellow, but produces a falt exceeding white.

Meliffantes in his new geography, p. 428. fpeaking of the falt-works the *Spaniards* have in *Catalonia*, affirms, that there is rock-falt, whofe colour is diverfified in fuch a manner, that it yields all the rainbow colours, of green, red, yellow, and blue; but that by firft preparing, and then grinding it, it became white. The fame thing likewife happened to the red rock-falt of *Saltsburg*, which being pounded becomes white.

There is one thing very remarkable in this mine, namely, a chapel, which may eafily contain 100 people, cut in the rock-falt, with an altar, pulpit, facrifty, chairs and forms cut in the fame rock.

In this chapel they celebrate divine fervice once every year, the week after *Epiphany*. A Jefuit of *Eper* always preaches the fermon. This fervice was founded for the officers of the excife and the miners.

In thefe cuts there are four fountains of falt water, which they put into buckets, made of buffalo's fkins, fewed together, and draw it up by an engine, work'd by horfes, and convey it by pipes into the boilers, where they put the rock-falt to diffolve, which they afterwards boil, till it become like cryftal. By exprefs mandates of the Emperor no one may fell that foffile falt, nor may the *Hungarians* employ it for their own ufe, much lefs drive any trade with it; but they boil it all and export it into foreign countries.

They likewife find here a fort of cryftalliz'd falt, like the cruft fticking to the pipes of wood: The miners call it falt of cryftal; it is very white and tranfparent; but it appear'd to us nothing other than falt, falling drop by drop in its paf-

fage,

ſage thro' the pipes, and ſo cryſtallizing; and this they likewiſe eaſily ſeparate.

But that which is moſt curious and remarkable in theſe ſubterraneous foſſes, are the flowers of ſalt which grow like the beard of a goat; only with this difference, that theſe here are much whiter and finer. One cannot ſufficiently admire theſe vegetables; yet one cannot find them in all the cuts, nor at all times; but they appear, and grow according to the temperature of the ſeaſons, which in thoſe parts are very wholeſome, and without any thing noxious. Theſe plumes of ſalt are very brittle; they alſo melt in moiſt places, and diſſolve into a volatile oil; but yet they are the pureſt, fineſt, whiteſt, moſt acid, and moſt beautiful ſalt: So that it is not without reaſon they have given it the name of the flower of ſalt.

The ſalt of *Soówár* is reckoned the beſt of all *Hungary*; the greateſt part of it they export into *Sileſia*, *Moravia* and *Bohemia*; and the *Hungarians* dare not uſe any of it themſelves, under pain of baniſhment. They make every year about 50,000 ton; every ton containing 268 *lb*; but by an ordinance of his Imperial Majeſty they are to boil about 100,000 ton, which they are to export as the other. *Martin Zeiler*, in his deſcription of the Kingdom of *Hungary* p. 119. makes but ſlight mention of theſe rich ſalt-works.

In fine, we ſaw at *Neuſol*, at M. *De Neſſzern*'s, receiver of the Emperor's rents, a ſtatue of rock-ſalt, as large as the life, which ſerves as the barometer of *Neuſol*: For, when it begins to ſweat, or grow moiſt, it preſages rain, or wet weather; but when it is dry, you may certainly promiſe yourſelf ſettled fair.

After having employ'd three hours in viewing theſe ſalt-works; we aſcended again by the upper opening, by a common rope, and return'd to *Eper*, where we were civilly entertain'd by M. *Topprerer*, one of the moſt knowing men in all *Hungary*, Rector of the *Lutheran* Academy, and who underſtands and ſpeaks 10 languages in perfection.

The Natural Hiſtory of Cochineal; *by* Melchior de la Ruuſchor. Phil. Tranſ. N° 413. p. 264.

A Diſpute ariſing between *Melchior de la Ruuſcher* and a friend of his concerning the ſubſtance of cochineal; the one maintaining it to be a ſmall animal; and the other the fruit

fruit or grain of a plant: The former procur'd from *Antiquera* in *New Spain* (the place where there is the greateſt traffic for it) the atteſtations upon oath of eight perſons, who have been immediately employ'd in propagating and managing it for many years: Whence the whole natural hiſtory of this drug is collected. Theſe atteſtations ſhew,

1. As to cochineal itſelf, that they are ſmall animals, with a beak, eyes, feet and claws; that they creep, climb, ſeek their food, and bring forth young without changing their ſpecies, as ſilk-worms do; but producing their like; which are no larger than nits, or ſmall mites, or the point of a needle; but when come to maturity, reſemble, both in ſize and figure, a dogs's tick. This far is certain; but their manner of generating is doubtful; tho' it be commonly believ'd by thoſe who cultivate them, that they are impregnated by a ſmall butter-fly, which is bred upon the *Nopal* (the plant they live upon) which paſſes and repaſſes over them.

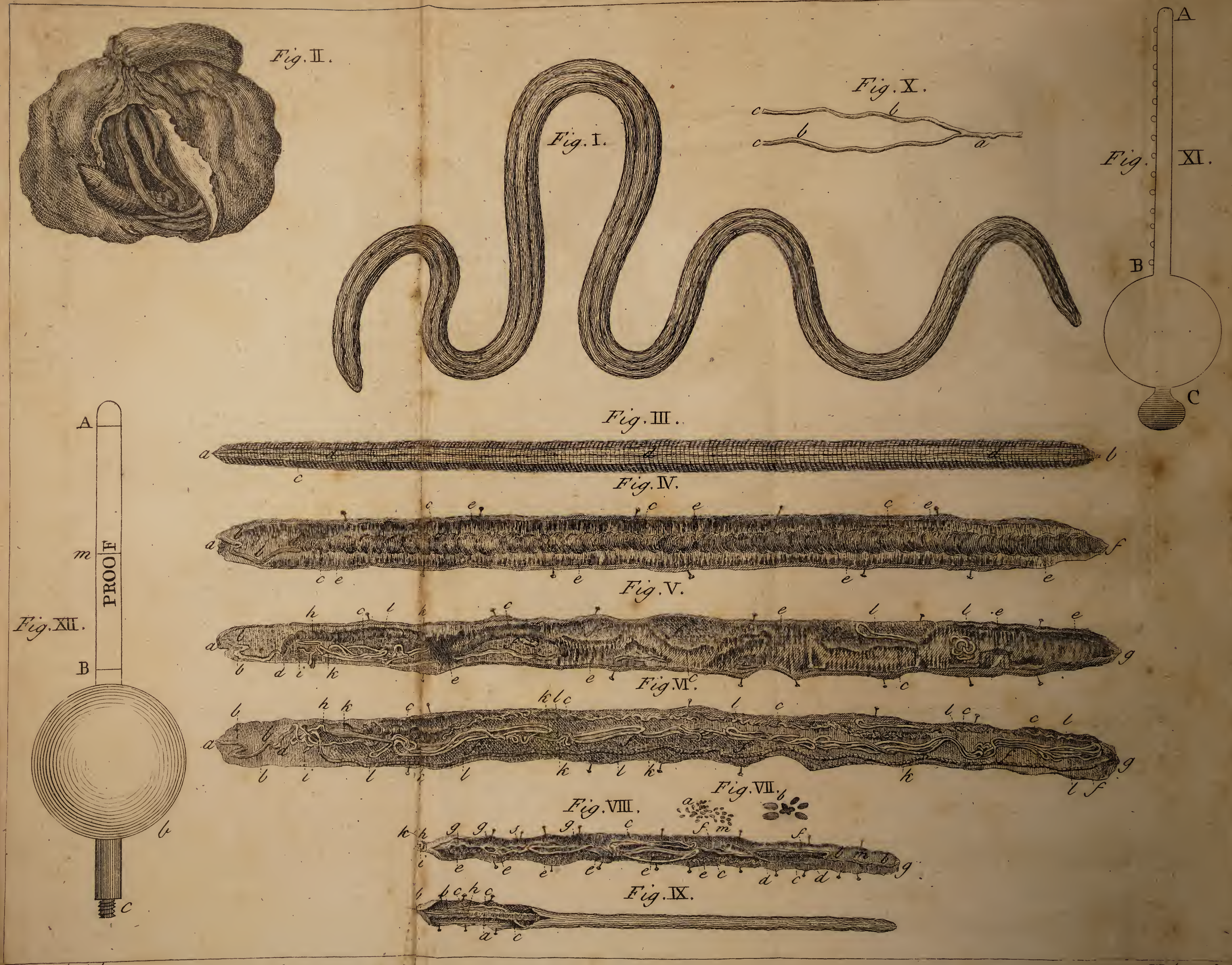
2. As to the manner of raiſing, nouriſhing and managing them; it appears, that at the proper ſeaſon, namely after winter (when theſe little animals can bear the open air) when the cochineals, which they have kept in their houſes, are grown ſo large as to produce young ones ſoon; they put 12 or 14 together into a *paſtle*, or little neſt, made of fine ſoft hay, or ſtraw, or moſs of trees, or the down which immediately envelopes the cocoa-nut. Theſe *paſtles* are then placed upon the plants of the *Nopal*, or prickly *Indian* fig (which they take care to cultivate well for this purpoſe) and in 2, 3, or 4 days, theſe animals bring forth a great many young ones; ſoon after which, the dams die. In the mean while the young ones, coming out of the neſts, climb up the *Nopal*, fix themſelves to it, and ſuck its juice, which is their only nouriſhment, but they do not eat the plant; and for this reaſon they always ſeek theſe parts of it that are greeneſt, and fulleſt of juice, taking care at the ſame time to place themſelves on the parts, moſt ſheltered from the wind and weather. During this time, whilſt they are growing up, and become pregnant, great care is taken that no vermin incommode or kill them, as alſo to keep them clean, and diſengage them from certain threads, like cob-webs, that grow upon the *Nopal*, as likewiſe to defend them from too much heat, or cold, and from the rain or winds; becauſe the fine cochineals are very tender: Nevertheleſs the wild cochineals

ſtand all theſe inconveniences; but then they are ſo gritty, of ſo ill a ſmell, and of ſuch little value, that they ought not to be mixt with the fine.

3. As to gathering the cochineal: The firſt is of the dams, which, having brought forth their young, died in the neſts. Three or four months after this, as the ſeaſon permits, when the firſt young ones are become ſufficiently large, and are in a ſtate to bring forth young ones in their turn, and have alſo produced ſome few; the *Indians* carefully gather them off the *Nopal* with a ſmall ſtick, to which they fix a little hair in the nature of a pencil. Theſe animals being collected in this manner, and afterwards kill'd by hot water or fire, are call'd the ſecond gathering, or rather the firſt of the young ones, that have been nouriſh'd and rais'd in the open air. Three or four months after this, they gather the ſecond brood of thoſe that have been brought forth upon the *Nopal*, which being grown big, have already brought forth ſome young ones. This they do much in the ſame manner as before, only now they take off the plant a great many young ones with their dams, which makes this ſort of cochineal to be call'd *granilla*, from the number of ſmall ones found therein. In the mean time they keep a number of theſe young ones alive upon the *Nopals*, which they pluck up or cut, and lock up in their houſes, in order to nouriſh them during the rainy ſeaſon. Laſtly, theſe being grown large, they put them into the *paſtles*, and proceed in the manner above expreſſed in the ſecond article. So that for the moſt part they make three gatherings in a year.

4. As to the manner of killing the cochineal: This is commonly done two ways, either in hot water, or in *Tamaſcales*, which are little ovens made for that purpoſe; tho' there be ſome people that kill them by roaſting them upon *comales*, which are flat ſtoves with fire under them, made uſe of by the *Indian* women to bake their *maiz* bread. Theſe three different methods give the cochineal three different colours. The firſt renders them of a brown red; the hot water making them loſe the white colour, with which they are covered when alive. The ſecond makes them of an aſh colour, and marbled or jaſpered; both on account of the natural white with which they are covered, and the red and tranſparent colour of the cochineal itſelf. The third ſort becomes black, as if it had been burnt. Of the old ones which died after dropping their young, four pounds, when dried, produce but

one;



G. Smith del. Hulett Sculp

one; or rather one pound is reduced to four ounces: But three pounds only of the living, which have been carefully taken off the *Nopals*, being kill'd and dried, produce as much.

This is the ſubſtance of the atteſtations, *&c.* which contain ſeveral circumſtances hitherto unknown, both in M. *Ruuſcher*'s country (*Holland*) and elſewhere: And as the curious may now be aſſur'd of a thing, which has been very uncertain for ſo many years; and indeed known but very ſuperficially, even by thoſe who have embraced the opinion, that the cochineal were really little animals; and as there may be always a ſtanding evidence to evince the truth of theſe facts, the original atteſtations, confirmed by the certificates of three magiſtrates and three publick notaries, are depoſited among the regiſters of the *Royal Society*.

An Anatomical Deſcription of Worms, *found in the Kidneys of* Wolves; *by M.* Klein. Phil. Tranſ. N° 413. p. 269.

THE worms were ſent M. *Klein* from *Sewaldia* in *Eaſt Pruſſia*.

Fig. 1. Plate II. repreſents a female worm found in the kidney of a ſhe-wolf.

Fig. 2. The kidney of the wolf, reſembling a bag, on account of the almoſt entire conſumption of its *parenchyma*. It contain'd eight worms; ſome of a yellowiſh; others of a blood-colour; two of which were females, and ſix males.

The females were more than twice longer and thicker than the males: They were furniſh'd with three very viſible holes; the firſt of which performed the function of the mouth; the ſecond of the *anus*; the third of the *vulva*. This laſt hole is ſeen under the belly at *a b c* Fig. 3. about one inch and $\frac{1}{2}$ from the mouth.

The membranous ſkin was marked with annular fibres, and ſeven or eight cheſnut-colour'd lines, as at *d*, running the whole length of the worm. The ſkin being cut, a limpid humour iſſu'd forth, and then appeared the tranſverſe fibres, interlaid on every ſide with the *viſcera*, and inſerted all round about into the ſkin in the interſtices of the veſicles (of which hereafter) and at the ſame time the *viſcera* appear'd, which the parts, deſtin'd for nutrition and generation, ſeem ſolely to make up.

The alimentary paſſage is compos'd of two canals, one of which *bb* (Fig. 4.) that begins at the mouth, and is about two inches long, ſmooth, fleſhy, whitiſh, and endow'd with thick coats, ſerves for receiving the nouriſhment. As this duct, proceeds with equal thickneſs, it is once reflected and retorted before it enters the other *cccd* which is of a dark brown colour, much broader and tenderer than the firſt, flatted, membranous, cover'd with very fine coats, wrinkled like a ſwathing cloth, then runs into tranſverſe and winding ſinews, and extends in a ſtreight line to the *anus*. The inner coat of this canal ſeemed rough and ſtrew'd with duſt, as it were. The liquor contain'd therein was perfectly fluid, and of a faint, ſooty colour.

Near the *anus* was fix'd to the ſkin the end of a whitiſh, tender veſſel, which from thence proceeded ſtraight to the beginning of the alimentary canal, where reflecting towards its origin, and again reſuming its firſt way, after being contorted and implicated in many and various windings and curves, widens and ſtreightens here and there, till at length becoming more and more capacious, it forms a little bag, for which a whitiſh, fine, ſmooth, canal, about an inch long, covered with pretty thick coats, piercing thro' the ſkin, an inch and a half from the mouth, prepares an outlet, mark'd under the belly with a caruncle, as at *c* Fig. 3: *b* Fig. 4, 5. This little canal may, not improperly, be call'd the oviduct or *vagina*.

The colour of theſe parts is not every where the ſame; for, from a whitiſh colour at the beginning, in its progreſs it inſenſibly becomes darker: And at length, where the veſſel acquires a greater volume, and eſpecially where it ſtretches forth into the bag, it is of a cheſnut colour: And as far as this cheſnut colour continues, the veſſel is thick ſtuff'd with miriads of *ova*; and therefore may be call'd the *ovarium*,

The *ova*, whoſe number is incredible, ſeen with the naked eye, reſemble a *magma* of a brown colour; but view'd thro' thoſe microſcopes, which in the *Engliſh* apparatus are mark'd 2 and 3, they are of the figure repreſented at *a* and *b* Fig. 6.

The ſurface of the inner ſkin, which inclos'd the abdominal contents, was all beſet with ſmall whitiſh bladders, of different figures and ſizes, which upon tearing, poured out a *lympha*. Theſe were in the females.

Tho'

Tho' the integument of the male throughout its whole length be markt with annular fibres, and as many chefnut-colour'd lines, as that of the female; yet his external ſhape differs from that of the female. 1. Becauſe as has been already ſaid, he is much leſs. 2. Becauſe the third hole, *viz.* that under the belly, is wanting in the male. 3. Becauſe the *anus* of the male is ſurrounded with a thick cartilaginous membrane, nearly of an orbicular figure, about a line broad, externally convex, internally concave; on the middle of which appears a tubercle, divided by a fine ſlit, which lets out the *fæces*, and a very ſmall capillary proceſs *k*.

The cavity of the belly (Fig. 7.) contain'd a limpid humour, tranſverſe fibres, alimentary canals, and ſpermatic veſſels.

The alimentary paſſages had the ſame ſituation and ſtructure, as in the female; the anterior canal was of a whitiſh colour; the poſterior or wrinkled one, of a pale brown.

The ſpermatic veſſels were very white and ſlender, yielding when wounded, a milky humour; they are divided into two ſmall branches, hanging out of a vermicular proceſs (ſcarce an inch long) which lies in the belly, in that place where the alimentary canals are joined together, and leans on the ſide of the wrinkled canal, by means of the tranſverſe fibres. Theſe branches, in their progreſs hence, creeping above and below the alimentary canal, are very often reflected, intorted and folded: One at length freed from its windings, ſtretches away ſtraight towards the *anus*, into which it is inſerted in the ſhape of a pretty ſtiff veſſel; but the other, at the ſide of the wrinkled canal, being preſs'd, collected, and equally inflected, almoſt thro' its whole extent, by the tranſverſe fibres, terminates in the oppoſite ſide by an extremity, pendulous in the belly, not far from the *anus*.

The inner coat of the ſkin, juſt as in the females, is all cover'd with ſmall whitiſh bladders, turgid with *lympha*, but leſs in proportion to the leſſer ſize of the worm.

Under the wrinkled canal M. *Klein* found a certain whitiſh duct, markt with the letters *b*, *b*, *b* (Fig. 8.) firmly connected with the aforeſaid inteſtine by its fineſt part; but whoſe outlet, or origin, the tenderneſs of the inteſtine, and the fineneſs of the duct, hindered us from tracing with exactneſs.

The following figures repreſent the worms, drawn as big as the life.

Fig.

Fig, 3. repreſents a female worm; *a* the mouth of the worm; *b* the *anus*; *c* the *vulva*; *d* the cheſnut-colour'd lines, running along the worm's length.

Fig. 4. *a* the worm's mouth; *b* the alimentary tube, which is white, carnous, *&c.* *c* the alimentary tube, which is brown and flatted, and whoſe extremity is in the *anus*; *d* the place where both join; *e, e, e,* the tranſverſe fibres; *f* the *anus.*

Fig. 5, 6. *a* the worm's mouth; *b, b* the firſt alimentary tube; *c, c* the ſecond; *d* the place where both theſe are connected; *e, e, e,* the tranſverſe fibres; *f, f, f* the white veſicles turgid with *lympha*, with which all the inner ſkin is thick beſet; *g* the *anus*; *h* the *vagina*; *s* the *oviduct*; *i* the outlet of the *vagina*, or the *vulvæ*; *k, k* the *ovarium* filled with a vaſt many *ova*; *l, l* the *vaſa præparantia.*

Fig. 7. the *ova*, view'd thro' a microſcope; *a* thro' the microſcope N° 3. *b* thro' the microſcope N° 2.

Fig. 8. repreſents a male worm; *a* the mouth of the worm; *b, b* the whitiſh alimentary tube; *c, c* the wrinkled alimentary tube; *d* the vermicular proceſs of the ſpermatic veſſels; *e, e* a branch of the ſpermatic veſſels, along the ſide of the inteſtine, compreſſed by the tranſverſe fibres, and inflected in an uniform manner thro' its whole extent; *f, f, f* the windings and turnings of the ſpermatic veſſels; *g, g* the tranſverſe fibres; *h* the cartilaginous membrane ſurrounding the *anus*; *i* the ſmall ſlit in its middle; *k* the very fine capillary proceſs; *m, m* the ſmall bladders covering the ſkin.

Fig. 9. repreſents a male worm inverted and diſſected about the *anus*, in order to ſee with eaſe the duct lying under the alimentary tube; *a* the wrinkled alimentary tube; *b* the whitiſh duct under the wrinkled tube; *c* the ſpermatic veſſels.

Fig. 10. *a* the vermicular proceſs of the ſpermatic veſſels; *b, b* the branches of the ſpermatic veſſels, freed from their windings; *c, c* the ſame branches diſſected.

Obſervations in Diſſecting an Oſtrich; *by Mr.* Ranby. Phil. Tranſ. N° 413. p. 275.

MR. *Ranby* adds two or three obſervations, that eſcaped his notice in diſſecting the oſtrich he gave an account of in *Phil. Tranſ.* N° 386. p. 223.

And firſt as to the eye; its figure, when taken out of the orbit, he takes to be particular, being almoſt triangular, with ſome little variation in the bony ſcales. The contents of the

ſtomach

ſtomach were of ſuch a kind, that they were hardly capable (without very great alteration) of paſſing the lower orifice, which is very ſmall.

The diameter of the *duodenum* is much ſmaller than any of the inteſtines and free from valves, as are the *jejunum* and *ileum*; excepting the latter, which has a few valves, as it approaches near the *colon*. The *colon* was uneven, with very regular cells; theſe cells were formed by valves, which were on the inſide, and tranſverſely ſituated, each making more than half a circle.

The parts in other reſpects agree with the deſcription given by the ſeveral curious Gentlemen, who have diſſected this animal.

A new Kind of Hydrometer; *by Mr.* Clarke. Phil. Tranſ. N° 413. p. 277.

THE hydrometer, by ſome called areometer, is an inſtrument, commonly made of glaſs, conſiſting of a ſtem A B (Fig. 11. Plate II.) graduated by ſmall beads of glaſs of different colours, ſtuck on the outſide; a larger ball B, quite empty, as well as the ſtem; and a ſmall ball C, fill'd with quick-ſilver, before the end A was hermetically ſeal'd, in ſuch a manner as to make the hydrometer ſink in rain-water as deep as *m*, the middle of the ſtem. Such an inſtrument does, it is true, ſhew the different ſpecific gravity of all waters, or wines, by ſinking deeper in the lighter, and emerging more out of the heavier liquors: But as it is difficult to have the ſtem exactly of the ſame bigneſs all the way; and tho' it could be had, the ſame inſtrument could not ſerve for water and ſpirits, ſinking quite over head in ſpirits, when made for water; and emerging in water with part of the great ball out, when made for ſpirits. The hydrometer has only been uſed to find, whether any one liquor be ſpecifically heavier than another, but not to tell how much, which cannot be done without a great deal of trouble, even with a nice inſtrument. The hydroſtatical balance has ſupplied the place of the hydrometer, and ſhews the different ſpecific gravity of fluids to a very great exactneſs. But as that balance cannot well be carried in the pocket, and much leſs managed and underſtood by perſons not uſed to experiments, Mr. *Clarke* was reſolved to perfect the hydrometer, for the uſe of thoſe that deal in ſpirits; that by the uſe of the inſtrument they may, by inſpection, and without trouble, know whether a ſpirituous liquor be proof, above proof, or under proof; and exactly how much above or under. And this muſt be of great

uſe

uſe to the officers of the cuſtoms, who examine imported or exported liquors.

After having made ſeveral fruitleſs trials with ivory; becauſe it imbibes ſpirituous liquors, and thereby alters its gravity, he at laſt made a copper hydrometer, with a braſs-wire of about $\frac{1}{4}$ of an inch thick going thro', and ſoldered into the hollow copper ball, B*b*. Fig. 12. The upper ball of this wire is filed flat on one ſide for the ſtem of the hydrometer, with a mark at *m*, to which it ſinks exactly in proof-ſpirits. There are two other marks A and B, at top and bottom of the ſtem, to ſhew whether the liquor be $\frac{1}{10}$ above proof (as when it ſinks to A) or $\frac{1}{10}$ under proof (as when it emerges to B) when a braſs weight, ſuch as C, has been ſcrew'd on to the bottom at *c*. There are a great many ſuch weights of different ſizes, and markt to be ſcrew'd on, inſtead of C, for liquors that differ more than $\frac{1}{10}$ from proof; ſo as to ſerve for the ſpecific gravities in all ſuch proportions, as relate to the mixture of ſpirituous liquors, in all the variety made uſe of in trade. There are alſo other balls for ſhewing the ſpecific gravities quite to common water, which makes the inſtrument perfect in its kind.

An Aurora Borealis *at* Geneva, Feb. 15. 1730. N. S. *by M.* Cramer. Phil. Tranſ. N° 413. p. 279.

THE *aurora borealis* itſelf had nothing extraordinary; it was a quiet one, that is, without any ſenſible motion, excepting, perhaps, an alternative increaſe and diminution of apparent altitude. Whether it was for this reaſon, or becauſe the light had its edge imperceptibly confounded with the colour of the heavens, ſeveral people judged of that altitude ſeverally. There are ſome who pretend to have ſeen it to the very zenith: M. *Cramer* was not ſo happy, and could not ſee it higher than the girdle β of *Cepheus*, which was about 30° high. The greateſt part fixed itſelf to the pole ſtar, which is about 46°, its baſe reach'd from the head of *Andromeda* and further, to the ſhoulder (γ) of *Bootes* and further; and ſo it inſiſted on an arch of 140 or 150° of the horizon. This meaſure was taken $\frac{1}{2}$ an hour after 8. Its middle declined from north to weſt about 15°. The light was ſtill, and clear enough to read a character no bigger than that of M. *Cramer*'s letter. The baſe ſeemed obſcure to ſome people.

But what was chiefly to be conſidered was a large meridional zone, pretty like a rainbow in its figure, but broader; it was terminated by two parallel arches: The ſuperior inſiſted with one

ſide

ſide upon the true point of eaſt, and with the other upon the point of ſouth-weſt, or weſt-ſouth-weſt: Whence we ſee its middle declined about 15° from ſouth to eaſt, and it was diametrically oppoſite to the middle of the *aurora borealis*. Its altitude varied a little, but never reach'd higher than the head of *Orion*, which was 54° high; and never was ſeen lower than a little under *Procyon*, which is an altitude of 45 or 46°. The inferior arch was exactly parallel to the ſuperior; and the breadth of the zone varied from 14 or 15° to 18 or 20°.

The colour of this zone was red, ſcarlet, inclined to purple, pretty lively, and changeable by intervals. It was leſs vivid near the horizon, and alſo near the meridian, where it ſeemed now and then interrupted. Some by-ſtanders imagined two great arches riſing; one from the eaſt, the other from the ſouth-eaſt, and meeting together near the meridian, but immediately afterwards parting from each other, and drawing back; which they repeated very often.

Under this zone then was to be ſeen, but not conſtantly, one or two arches, lucid and interrupted; which comprehended with the horizon a dark ſegment very like a miſt.

The phenomenon laſted till 4 o'clock in the morning. The weather was calm, ſerene and cold; the barometer very high; no cloud in the heavens.

It was remarkable, and M. *Cramer* thinks extraordinary, that this *aurora* conſiderably darkened the light of thoſe ſtars, which were ſeen thro' it; and that was much truer of the red meridional zone, which dyed with its reddiſh colour the ſtars that appeared behind. When that zone was the higheſt, it cover'd *Jupiter*: and ſome Gentlemen, who at that time had not yet remark'd the *aurora*, looking at *Jupiter* thro' a teleſcope, affirm they could hardly ſee it, but that it ſeemed as intercepted by ſome dark cloud; and indeed, it looked at that time, as if it had been ſeen thro' a red glaſs.

This obſervation confirms what is beſides very probable, that this zone was produced by the light of the oppoſite *aurora*, either by reflexion or refraction. But the manner of its production ſeems difficult to be accounted for. There may be ſuppoſed icy particles floating in the air, and of ſuch a figure, as to exhibit a large zone, by the reflexion and refraction of the light of the *aurora*; almoſt in the ſame manner as the drops of rain produce the appearance of the rainbow: But this being mere conjecture, M. *Cramer* paſſes it over.

The *aurora* and zone ſeem'd a great deal nearer each other in the horizon than in the top. If we could ſuppoſe this difference to be entirely optical, and theſe two circles really parallels, that would be ſufficient to compute the diſtance of the phenomenon from the earth. But the ſuppoſition, tho' it ſeemed at firſt pretty allowable, is by no means to be admitted; For, it would follow, that the phenomenon was at leaſt diſtant from us $\frac{1}{24}$ part of the diameter of the earth, which is too great an altitude.

Young Aſh-trees *ſpringing from rotten* Wood; *by the Same.* Phil. Tranſ. N° 413. p. 282.

A Friend of M. *Cramer*'s having caus'd ſome aſhen pipes (that convey'd water to his fountain, for at leaſt 12 years) to be taken out of the earth; they were left in an unpaved yard, where they almoſt entirely rotted; but in their room there ſhooted forth from the earth a little foreſt of aſh-trees: They are now in a flouriſhing way, and about three or four foot high. It is remarkable, that more than 50 young trees are ſprung up exactly where the pipes had been laid, and no where elſe in the yard. There is no aſh-tree thereabouts, nor perhaps at a very great diſtance.

An Account of a Spiritus vini æthereus; *together with ſeveral Experiments tried therewith*; *by Dr.* Frobenius. Phil. Tranſ. N° 413. p. 283.

Exper. 1. THE æther of plants appears to be almoſt deſtitute of all groſs air, from placing it under the receiver of the air pump: For, exhauſt the air ever ſo accurately, this ætherial liquor remains unmoved; nor does it emit any air-bubbles, which immediately ariſe in other liquors; and according as their quantity of intrinſic air is greater, ſo much the ſooner are ſuch liquors put into agitation, emit more froth, and excite more vehement ebullitions, in proportion to their viſcidity. Hence it follows, that this æther may be preſerved beſt (becauſe without any diminution) under the receiver *in vacuo*; whereas on the contrary, expoſed to the open air, its parts ſoon evaporate; and its whole bulk, but not compreſſed by the air, vaniſhes. (*This experiment fail'd remarkably.*)

Exp. 2. A little of it, pour'd on the ſurface of the hand, affects it with a ſenſe of cold, equal to that from the contact of ſnow; and blow upon it but once or twice with your mouth, your hand immediately becomes dry. However, beware of approach-

approaching a lighted candle with your hand thus wetted, left it take fire and burn you. (*Succeeded.*)

Exp. 3. Being poured upon hot water, it causes such a stridor and hissing, as is frequently occasioned by a piece of hot iron thrown therein. Take a lump of sugar, let it imbibe some of this æthereal liquor, and put it into a vessel full of hot water, the sugar will, it is true, sink to the bottom, but the æthereal liquor rushing violently forth, excites a great ebullition in the water. If a spoonful of this æther be pour'd into a copper-pot full of boiling water, without any sugar in it, and approach immediately with a candle or a lighted paper, there instantly issues forth from the water very great lightning. The handle of the spoon, as well as the tongs for holding and applying the lighted paper, must be of a proper length, that the pouring of the æthereal liquor upon the hot or boiling water, and the application of the lighted candle or paper may be performed at the same time; otherwise the æther is immediately dissipated, without any such effect. 'There is, therefore, need of an assistant, or of both hands; and likewise of a room where fresh 'air may be readily admitted, proportionable to the magnitude 'of the flash of lightning, which rarifies the air in such a 'manner, as to endanger the stoppage of respiration.' (*Succeeded.*)

Exp. 4. Hence it appears, that this æther is both fire and a very fluid water; but so volatile that it soon evaporates, and that it is the purest fire: Insomuch that if kindled in a thousand times the quantity of cold water, it burns inextinguishably: Wherefore, if you take an earthen vessel of any magnitude, whose mouth or orifice may be one or two yards wide, but the inferior part of the vessel contain 600 or 6000 gallons of water, (the experiment will be the same) pour on the top but one ounce, or a small phial full of this æther, and apply it to a lighted wax candle, it takes fire immediately, burns placidly, and is so far from being extinguished by the most profuse superfusion of common water, that it much increases the vehemence of the flame, and lasts till the subtile parts of the æther are consumed and ventilated by the flame. This experiment should be made in a large and high room, not in danger of taking fire. (*Not shew'd.*)

Exp. 5. The sense of touch does not discover the least oiliness or fattiness in this æthereal liquor; tho' it be the true, natural, and only dissolvent, or menstruum of all fat, oil, rosin and gum whatsoever: By means whereof all sorts of fat, and every kind of fire or flame, is extricated by a ſpeedy, ſafe, and pleaſant operation. On theſe accounts it is that this æthereal liquor will not unite with any kinds of ſalts whatſoever; but all ſorts of oils, pitch, turpentine, opobalſams, camphire, wax, ambergris, *ſperma ceti*, maſtick, muſk, copal and the like, it diſſolves moſt readily, and with the greateſt eaſe extracts their beſt eſſences.

Exp. 6. And, indeed, a wonderful harmony is obſervable between gold and this æther, even greater than between gold and *aqua regia:* Inſomuch that from hence gold appears to approach nearer to the nature of oils than of earths, as ſhall be proved, when we treat in their proper place of the three harmonious *menſtrua*, which we have diſcovered, *viz.* the corroſive *menſtruum* for the devoration or ſolution of earths, minerals, and metals; the aqueous *menſtruum* for the ſolution of all kinds of ſalt; and laſtly the æthereal liquor, or oleous *menſtruum*. If a piece of gold be diſſolved in the beſt *aqua regia*; and an ounce and a half (or what quantity you pleaſe of the æthereal liquor) be pour'd upon the ſolution, cold; ſhake the glaſs carefully, and all the gold will paſs into the æthereal liquor, and the *aqua regia*, diveſted of all its gold, will preſently depoſite the copper at the bottom of the veſſel, like a white powder, which, turning of a green colour, contains the portion of copper, with which the gold was adulterated. The æther will ſwim like oil on the ſurface of the corroſive waters. The experiment deſerves the utmoſt attention: For, here the heavieſt of all bodies, namely gold, is attracted by this very light æther, or (whereas the air, which, with a common force, preſſes alike all bodies, is here excluded, and the æther itſelf encompaſſes and touches the ſurface of the water) the gold by the force of its gravity, as by an impulſe, would deſcend from thence; or laſtly, this phenomenon is owing to a certain harmony and ſimilitude of both of them. (*Succeeded.*)

Exp. 7. Æther then is certainly the moſt noble, efficacious and uſeful inſtrument in all chemiſtry and pharmacy; *ubi enim ignis potentialis, ibi actuali non opus eſt*; inaſmuch as eſſences and eſſential oils are immediately extracted by it, without ſo much as the mediation of fire, from woods, barks, roots, herbs, flowers, berries, ſeeds, &c. as alſo from animals and their parts: Thus, from caſtor, by a certain manufaction, may be prepared an oil ſweeter than that of cinnamon, and alſo the true oil of ſaffron, of wonderful efficacy; and all by this particular encheireſis, without the help of fire or diſtillation: For an an example, take mint, ſage, or orange-peels, cinnamon, &c. or all theſe together; cut and bottle them up; pour on them a ſpoonful or two of the æthereal liquor; and after it has ſtood an hour in a cold place, fill up the bottle with cold water, and you ſhall ſee the eſſential oil, ſwimming on the water, poured upon them, eaſily ſeparable by the funnel, or *inſtrumentum tritorium:* Of this eſſential oil one drop only upon a lump of ſugar, manifeſts to the taſte, &c. the medical virtues of the plant, exquiſitely drawn out, comprehended in this eſſence, and deſervedly named Cos; as containing the colour, odour, and ſapor or taſte of the plant of plants: In like manner, the eſſential oils of exotics are eaſily prepared. (*Succeeded*) But it is not a true eſſential oil, but an exceſſive ſtrong tincture, which you may call the eſſence).

Exp. 8. Of the like uſe it alſo is in the animal kingdom, where it produces an eſſential oil of *phoſphorus*; as likewiſe in the mineral kingdom; tho' not ſo immediately, becauſe the reſolution of earths muſt preceed: It is, moreover, eaſily proved, that the ſame liquor extracts the pureſt gold, or every part of the golden ſyſtem from any, or all the baſer minerals: And that this gold, thus extricated, is by this one operation better and ſooner purified than by fuſion of minerals with antimony.

Exp. 9. This our water is neither corroſive, nor joined with apparent corroſives: Wherefore, fill as many bottles with æthereal water, as there are ſorts of ſalts; and into the firſt drop oil of vitriol, put into the ſecond, ſpirit of ſea-ſalt; into the third, ſpirit of nitre, or of alum, or of ſal-armoniac, prepared with water, or the lixivium of tartar, or rectified wine-vinegar, all the ſalts immediately ſink to the bottom: Beſides, it is the lighteſt of all liquors; for, fill any veſſel with 20 ounces of oil of vitriol, the ſame emptied, will contain but 7 of æther: It is the very *ens*, or being, moſt pure of flame; wherefore, neither ſoot nor aſhes are ever found upon its deflagration (*Succeeded.*)

Thus far Dr. *Frobenius*: But to make this account more than a mere harangue, it is abſolutely neceſſary to ſubjoin two paragraphs out of a paper of that excellent chemiſt Mr. *Godfrey* (Dr. *Frobenius*'s fellow-labourer in theſe experiments) which he delivered in to the *Royal Society*, when this æther was made public before them.

' *Feb.* 19, 1729-30. That this æthereal liquor was formerly very much eſteemed and enquired into, doth clearly appear by an experiment I made formerly for Mr. *Boyle*, by 'by means of a metallic ſolution, namely, by the ſolution 'of crude mercury. united with the *phlogiſton vini*, or other 'vegetables, and this æther ſwam on top of the ſolution, 'which I ſeparated *per tritorium*. *Note*, this is what I have 'formerly done in Mr. *Boyle*'s laboratory, and Sir *Iſaac* '*Newton* was very well acquainted with it; which by reaſon 'of ſhortneſs of life was not brought to a full end, to do it 'ſo readily in quantity. But when Dr. *Frobenius* by experi-'ments made on this in my laboratory, produced it in greater 'quantity; he wanted to ſee how far Sir *Iſaac Newton* had 'gone on with it in his book. There we ſaw that great man's 'application in fol. 330, that he had done it *cum ol. vitriol.* '*&* *ſp. vini*'.

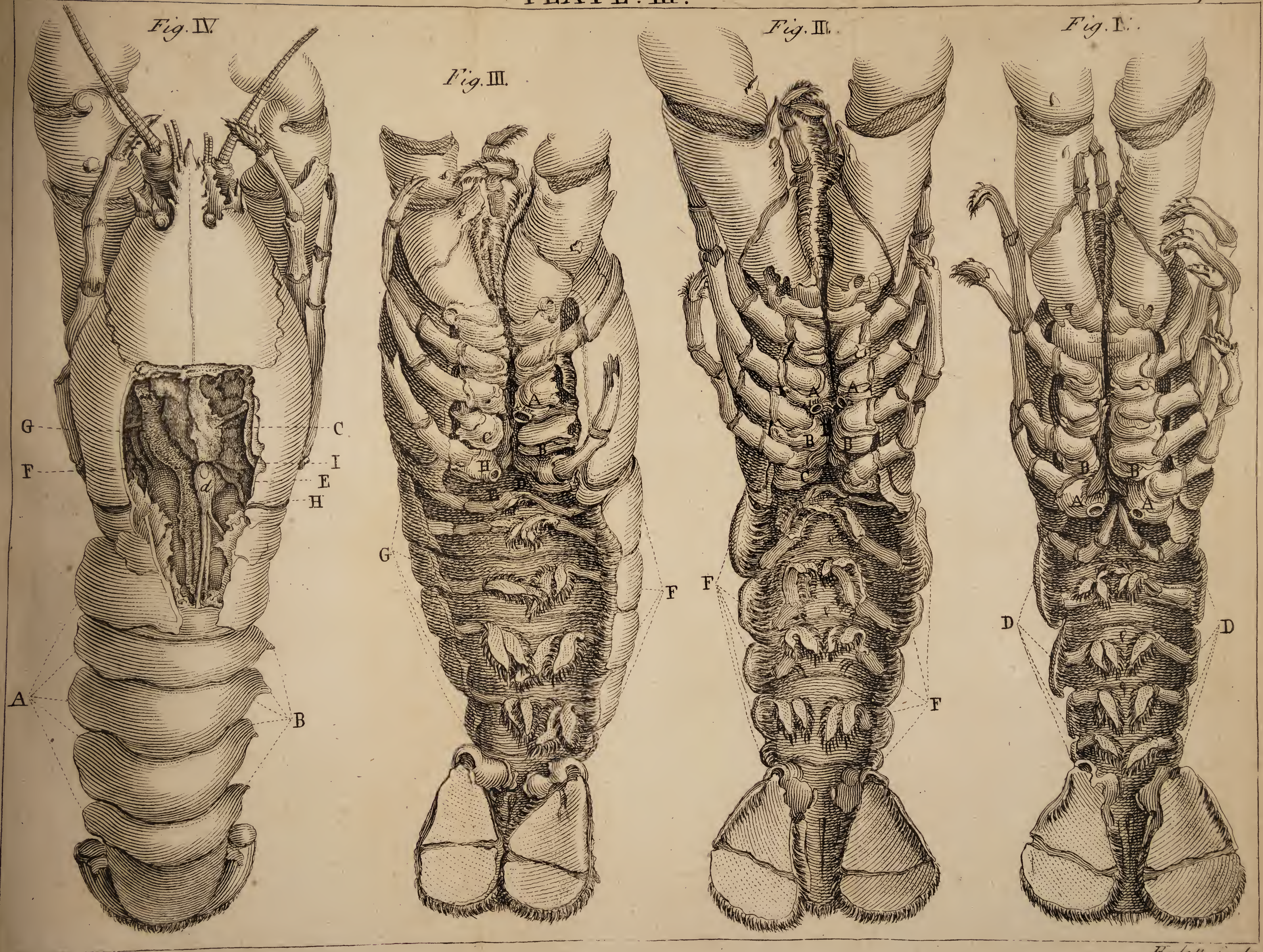
This of Sir *Iſaac Newton* is the *ſp. vini æthereus*; only there is a difference in the proceſs: The liquor *æthereus* is made with equal parts in meaſure, not weight: The upper yellow liquor is ſeparated from the inardent ſulphureous liquor *per tritorium*: The inferior liquor is thrown away, and the upper yellow liquor is put into a retort, to be diſtill'd with the moſt gentle heat; and the extracting of the æthereal liquor is continued ſo far till the ſuperior hemiſphere feel cold, and the retort being clapp'd in the hand, there be found in the receiver a vino-ſulphureous gâs, very æthereal. Let the ſulphur be precipitated by adding an *alkali*, and gently throwing it in till all ebullition ceaſe, and the liquor will not farther ſtrike itſelf againſt the hand, but ſtrangely attract it; then the *alkali* will of itſelf go to the bottom, or precipitate itſelf in the common water.

An Hermophradite Lobſter *diſſected*; *by Dr.* Nicholls. Phil. Tranſ. N° 413. p. 290.

IT is not eaſy to conceive, how an hermophradite can be formed in a ſpecies, of which each ſex has the parts, ſub-ſervient to generation, ſingle, and neceſſarily ſituated in the ſame parts of the body; at leaſt without either a very remark-able mal-formation of the body in general, or ſo perverted a ſituation of thoſe parts, as muſt very much impair their uſes. But in thoſe animals, whoſe parts of generation are double and independent on each other, as the lobſter, crab, and ſeveral birds, the parts proper to both ſexes may poſſibly be formed in the ſame ſubject, without prejudice to their uſes: But in that caſe the ſeveral parts can be but ſingle; and con-ſequently, the ſubject ſo formed cannot be call'd perfect as

to

PLATE. III.



G. Smith del.

Hulett Sculp.

to its ſpecies, in regard to either ſex; tho' it may be perfectly of both ſexes, ſo far as regards generation.

Under this idea of an hermophradite, Dr. *Nicholls* ventures to affirm, that the lobſter, referr'd to his examination, is truly one; and if ſplit from head to tail, is female on the right ſide, and male on the left.

To illuſtrate this, he gives a ſhort account of the ſtructure of the male and female lobſter; ſo far as relates to the difference between the two ſexes; and then he proceeds to ſhew in what manner they were combined in this ſubject.

It has been already obſerv'd that the lobſter, both male and female, has all the parts of generation double, only that the female has but one paſſage, thro' which it is probable the *ova* are emitted out of the trunk, in order to be affixt to the ſmall appendages under the tail.

The *penis* of the male lobſter riſes from the *teſtis*, and is no more than a continuation of the *vas deferens*; it is reflected and retorted once, after which it grows thicker, as to its ſubſtance (probably forming a *corpus cavernoſum*) and terminates, not in the laſt leg but one, as *Willis* in his *Treatiſe de animâ brutorum*, has obſerv'd, but at a ſmall perforated tubercle in the firſt bone of the laſt leg. A A (Fig. 1. Plate III.) repreſents the two *penes*.

Between the two laſt legs and the two legs above them are two proceſſes; which, from their reſembling the *nymphæ* of women, the Dr. calls *nymphæform* proceſſes: Theſe proceſſes are cover'd with hair, and unite at their baſes, without leaving any paſſage B B.

Below the two laſt legs, towards the tail, are two appendages, which, from their likeneſs, he calls the *ſtyliform* appendages: Theſe in the male, as CC are thick, hard, and without hair.

The tail is continued from the trunk in a gradual decreaſe of its dimenſion, and is covered by plates, which extend themſelves but little below the ſubſtance of the tail, and terminate in acute angles, as repreſented at D D.

It is to be obſerv'd, that ſometimes theſe plates are edged with ſhort and thin hair, and ſometimes they have none.

The female, on the other hand, in the place of the *teſtis* has an *ovarium*, which, like the *teſtis*, extends itſelf from the ſtomach to near one half of the tail. From the middle of the *ovarium*, a duct deſcends to the legs, that opens at a round hole, edged with hair in the firſt bone of the laſt leg

but

but two: This is the *uterus.* A A (Fig. 2.) reprefents the entrance into the two *vaginæ.*

The two proceffes B B, which in the female, he calls *nymphæform,* form a more obtufe angle at the union of their bafes; are lefs hairy, and leave a paffage D, thro' which it is probable the *ova* are emitted, in order to be affixed to the appendages under the tail.

The two ftyliform appendages in the female are foft, thin, and edged with long hair, as reprefented at C C (Fig. 2.)

The plates covering the tail in the females are extended much farther under the tail than in the males; befides, they diverge, in order to leave a larger fpace for containing the *ova*; for the better defence of which they terminate broad, and are edged with thick and long hair, as F F (Fig. 2.)

In the hermophradite lobfter the Dr. found all thefe parts, proper to both fexes, regularly difpos'd; but in fuch a manner that the parts proper to the female were to be found only on the right fide; and the parts, proper to the male, only on the left fide.

In the laft leg but two the *os uteri* A (Fig. 3.) was very obvious on the right fide, as in the females; but had not the leaft mark of any fuch paffage in the fame leg on the left fide.

The *nymphæform* procefs B (Fig. 3.) on the right fide form'd an obtufe angle at its infertion into the body, and was foft and perforated as in the females; while the correfponding procefs form'd a lefs angle, and was more hairy and rigid at its bafis, as in the male B.

The ftyliform procefs on the right fide D was foft, flat, and edged with hair, as in the female; but on the left fide E it was ftiff, hard, and without any hair.

In the laft leg on the left fide the perforated tubercle for the paffage of the *penis* H (Fig. 3.) was (as in the male) very difcernable; but without the leaft appearance of fuch tubercle in the correfponding leg on the right fide:

The plates covering the tail F (Fig. 3.) were extended on the right fide confiderably below its fubftance, and were edged with thick and long hair, and terminated broad, as in the female.

On the left fide thefe plates were much lefs extended below the tail; were almoft entirely without hair, and terminated in acute angles (G).

These

These plates likewise diverged on the right side, as in the females; but not on the left side, as in the males. A (Fig. 4,) represents the diverging of the plates on the right side; B the plates noways diverging.

Upon removing part of the great shell, the Dr. found the internal parts of generation in both sexes exactly corresponding to the external parts describ'd.

In the right side adjoining to the heart; the *ovarium* F was regularly dispos'd; it was full of *ova*, and sent off its oviduct or *uterus* G to the last leg but two.

In the left side the *testis* was rightly dispos'd as to its form, substance and situation; part of which he was obliged to remove, in order to shew the *penis* E, which terminated as in all males, at the tubercle in the first joint of the last leg I, part of the *testis* unremov'd.

He had some thoughts of removing so much of the great shell, as was necessary to shew the course and terminations of the *uterus* and *penis* at their proper orifices: But considering that by that means the tail would too easily separate from the trunk, and the appearance of the other marks be render'd less obvious, he chose only to lay them open at the back, thinking that to be sufficiently satisfactory to those who understand the structure of that animal. He steep'd it in three different sorts of spirits, and carefully dispos'd it in a glass, which he stopp'd in the best manner he could, that it might remain in the repository of the *Royal Society*, as an undeniable proof of so remarkable a fact.

Magnetical Observations and Experiments; by Mr. Savery. Phil. Transf. N° 414. p. 295.

1. WHAT he calls the magnetical line is the position of a dipping needle, when it ceaseth from oscillating, and is at rest in the magnetical meridian of the place.

2. By the word *magnet* (unless distinguish'd) he would be understood to mean not a loadstone only, but either that, or iron or steel, when they have permanent polarity, or any thing else (if to be found) which has a sensible magnetical or polar attraction.

3. He always calls that the north end of the magnetical needle, which (if hung horizontally) naturally turns to the north; and that the south end which turns to the south: But when he uses the words pole of a needle, he calls that the

 north

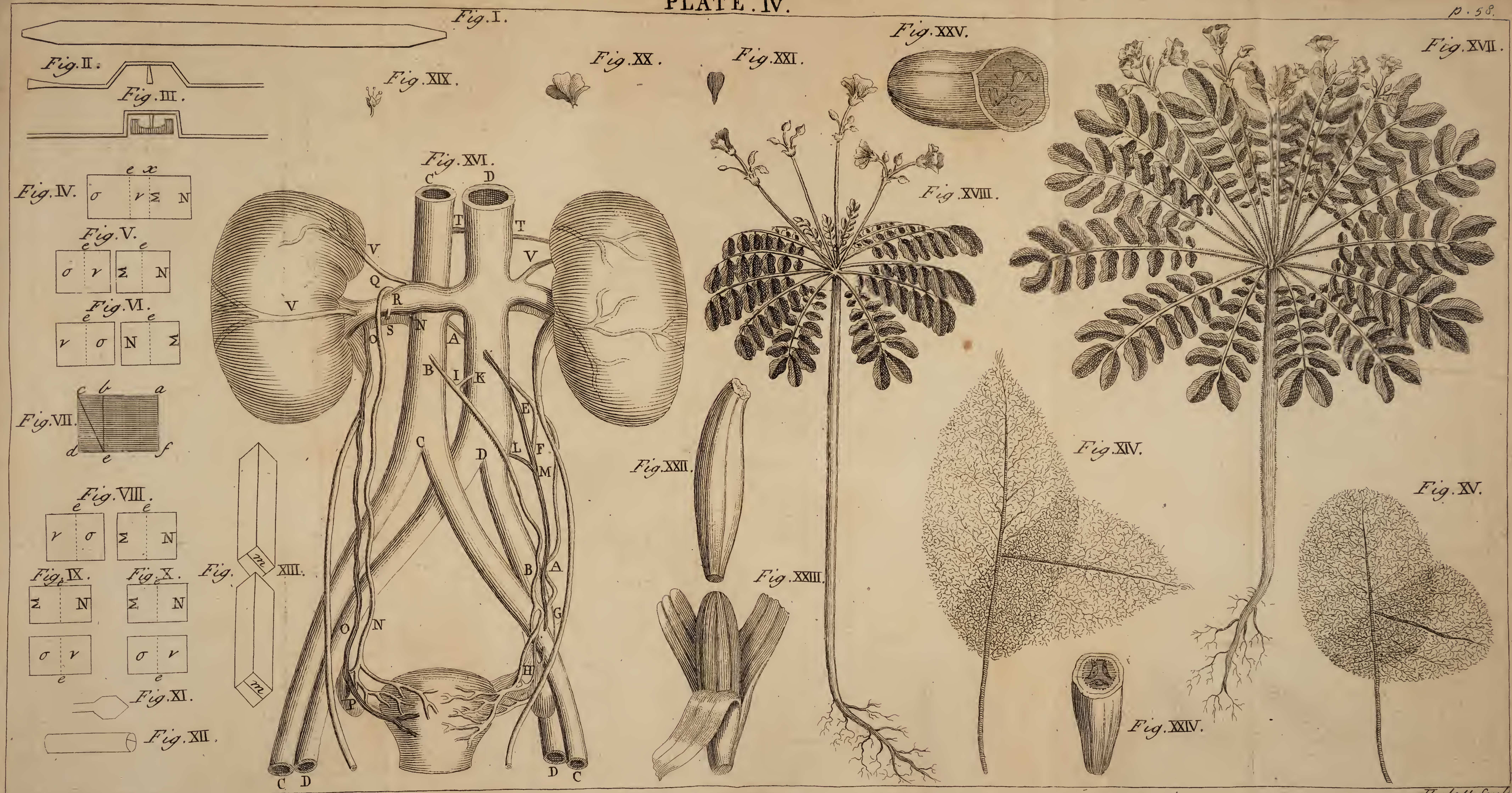
north pole thereof which turns to the ſouth, and that the ſouth pole of it which turns to the north.

4. He calls that the north pole of touch'd iron or ſteel (or of untouch'd, ſo long as it remains in a poſition which gives it polarity) as well as of the loadſtone itſelf, which attracts the north end, *i. e.* the ſouth pole of the needle; and that the ſouth pole which attracts the ſouth end, or north pole of the needle: Or in other words, he calls that the north pole in all ſorts of magnets, which is endu'd with the ſame kind of virtue, which the north pole of the earth hath, and conſequently is repell'd thereby: *E contra* &c.

5. He prepared nails of ſeveral ſorts, from the ſmalleſt ſort of bellows-nails to the largeſt ſort of rafter-nails, one or two of each ſort, or more of the ſmaller: He held each of them perpendicularly with its point upwards; and placing horizontally thereon the right ſide of a file, he filed off a little from the point thereof (more or leſs according to the ſize of the nail, perhaps about the thickneſs of a ſixpence from a ſixpenny one) then on a plane hone, held horizontally, he placed the nail upright, with its point downwards; and ſo rubbed off the ſtrokes of the file: Then he rubbed it a little on a piece of leather. *N. B.* The truer this little narrow plane is, and the more exactly perpendicular to the axis of the nail, the better.

6. He prepar'd iron bars of different lengths after the following manner: He made each end in the ſhape of the lower *fruſtum* of a pyramid, cut tranſverſe to its axis about the middle, or a little higher up: Then he filed the ends of the bar, as plain and perpendicular to its axis as poſſible; and poliſh'd them with a hone, *&c.* as he did the nails.

7. One of the needles (Fig. 1. Plate IV.) he us'd untouch'd for trying experiments, was made thus: He took ſome iron wire, about the ſize of a ſmall knitting needle, and in length about two inches and a half; with a hammer he made it juſt flat enough in the middle, to be able to fix the point of a punch, pointed to as true a cone as poſſible; its ſides (as he conjectures) formed an angle with each other at the vertex about 45 degrees or more; in the middle of the wire he punch'd a hole, at leaſt half way thro' the thickneſs thereof, and wrought the hole with a drill (pointed like the punch) that it might be exactly round, and cleans'd off the roughneſs, which the punch and drill had rais'd round the hole



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hole, left it ſhould injure the top of the pin, when it was placing thereon; then he bended it, as repreſented in Fig. 2. taking care to bend it the right way, that the hole might be on the under ſide. Then he mark'd one end, by flatting it a little with a hammer, that it might be known from the other: Then placing it on a ſharp pin, to find which end was heavieſt, he made both alike in weight, and diveſted it of all fixt magnetiſm. Then he brought it again to as true a poiſe as poſſible, by rubbing the heavieſt end on a whetſtone, and not a file, which might give it magnetiſm again: He fitted for it a pin of braſs wire, full as ſmall as the middle ſtrings of a ſpinnet, making the point very meagre and round, as well as ſharp, and he frequently obſerv'd it with a lens of two inches *focus*; and if it appear'd flat, he mended it on a hone, and took great care in putting on the needle, ſo as not to injure the tender point of the pin: He put a glaſs over it, to keep off all manner of fanning by the air, the leaſt degree whereof ſpoil'd the experiments.

8. He made a ſecond needle, which he thought better than the former, in the following manner: In the middle of ſuch a piece of wire, as the former was made of, he wrought a hole thro' it as perpendicular to its axis, or length, as poſſible, and as ſmall as any of thoſe, drill'd thro' the pillars of a watch, if not ſmaller; and having bent the wire as in Fig. 3. He mark'd one end thereof, and drove into the hole a ſmall braſs pin, fitted to it, very round and ſharp at the point, which reſted on a deep plano-concave lens of glaſs, well poliſhed, as in the figure. He fitted a box for it with a glaſs over it; which glaſs was faſtened with a ring of braſs wire, as the glaſſes of teleſcopes are; which ring kept out air, otherwiſe it had been needleſs: The glaſs concave was fix'd in the large end of a thin braſs ferule (like that of a ſtaff) juſt fit for it; and the ſmall end of the ferule was fixt in a hole made for it in the middle of the bottom of the box: He alſo put a ring of thin braſs on the top of the lens, not only to keep it in ſteady, but to prevent the pin from going in between the lens and the ferule, which ſpoils its point: But doubtleſs a concave of diamond is better.

Whenever Mr. *Savery* uſed one of either ſort of theſe needles (eſpecially, for ſuch experiments as requir'd it to be perfectly void of fixt polarity) he was obliged to keep it in a motion, either librating up and down like the beam of a pair of ſcales, or trembling, (which is a ſhort pendulous oſcillation from ſide to ſide) or elſe both librating and trembling at the ſame time; which ſaid two motions being at right angles with each other, are not inconſiſtent: And if the needle be truly pois'd, the horizontal verticity is neither obſtructed, nor accelerated by the librations; becauſe they are at right angles therewith; nor by the tremblings, becauſe the two ends perfectly balance each other in contrary motion. The ſervice they do is to abate that friction on the pin's point, which retards the horizontal verticity: For, when the friction is divided between the horizontal verticity, and the librations or tremblings (either of the two latter rolling on the pin more ſpeedily) the far greater part of the friction is ſpent on the librations or tremblings; and conſequently, there is but little left to retard the horizontal verticity. He takes ſuch a needle to be far better for his purpoſe than the common ones, which have a heavy ſocket of braſs, or ſteel, in the middle; only uſeful to render them portable, but very detrimental in nice experiments; becauſe the weight of the ſocket not only blunts the pin ſooner, but likewiſe increaſes the friction, tho' the ſame acuteneſs of the pin ſhould be ſuppos'd to continue. To renew the tremblings when they began to abate, he ſeldom jogged the box on the table, for fear of giving it (and the needle within it) a circular motion, which obſtructs the deſign: But he found it beſt to do it by jogging the table gently. When he had occaſion to turn the needle to any other point of the compaſs, he elevated that part of the box which was under one end, till it reſted on the bottom; and in that poſition he could turn it as he would; but before he could let down the box again to an horizontal poſition, he was obliged to wait till the needle was very ſtill, and to let down the elevated ſide eaſily, and with a direct motion: Otherwiſe the needle, as ſoon as both its ends were free, would have more or leſs of a horizontal motion.

The obſervations Mr. *Savery* made are as follows.

He was convinced by ſeveral properties of the load-ſtone, that there is no ſuch thing in nature as magnetical attraction without polarity, which is conſtituted of attraction and repulſion; and theſe two powers being always equally ſtrong in the ſame pole of every magnet, he takes it to be a plain contradiction to ſay, that this or that loadſtone has a ſtrong attraction, but a weak polarity of direction.

Every *fruſtum* of a load-ſtone is an entire or perfect load-ſtone, having in itſelf both poles as the whole ſtone had; and the

the poles in each frustum have their direction (as near as the figure of it will admit) in the same parallel line in which they were directed both in it and the whole stone, before it was separated therefrom: For, the polarity of every fragment is usually, if not always (before they are separated) parallel to that of the whole stone; and consequently, to that of each other: And if ever it be found otherwise, Mr. *Savery* cannot but think that that loadstone wants of perfection.

Let N Σ ν σ (Fig. 4.) represent a loadstone in the form of an oblong right angled parallelopipedon, whose polarity is lengthwise; N being its north pole; *e* the pricked line, its equinoctial (or middle between its poles) where it has no attraction, and σ its south pole: Let it be bissected at *e*, transverse to its polarity, or length: Each of its frusta (when placed too remote to act on each other) will infallibly be possessed of both poles (with its equinoctial in its middle) as the whole stone was before its bissection: And tho' originally the one frustum N Σ was all over a north pole; and the other ν σ all over a south pole, as while they adher'd to each other; yet now they are divided, and placed beyond the reach of each other's virtue, one half of the frustum N Σ from the place of its *quondam* contact Σ, to its middle *e*, does instantly become a south pole, and attract strongly at the place of contact aforesaid; which attraction is gradually less and less, till it be abated to nothing at *e*. In like manner one half of the frustum ν σ, from the place of its former contact ν to its middle or equinoctial *e*, instantly becomes a north pole (gradually abating in strength from ν to *e*) tho the whole frustum, before its separation from the other, was a south pole: The polarity being likewise directed the same way in each frustum, that it was in it (and the whole stone before the bissection. The case also would have been the same, if the stone had been divided unequally at $\varkappa$ or elsewhere transverse to its polarity; and one half of each frustum would have been a north pole, and the other half a south one, with it equinoctial in the middle as before. The whole stone will lift a larger iron than either frustum; but both frusta, while out of the reach of each other's virtue, will each of them lift his iron; both which irons will be heavier than what the whole stone could lift before it was divided. If the said frusta are again joined close together at the same ends, which originally adher'd (Fig. 4.) being as they stand directed towards each other (Fig. 5.) or if the opposite ends of both are joined together, as they stand directed towards each other (Fig. 6.)

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Mr. *Savery* does not ſee (provided the joint be very good, that there may be a contact all over it, as good as a workman can make) why they ſhould not again compoſe one entire loadſtone, in all reſpects as good as it was before it was divided (allowance being firſt made for the waſte in ſawing it aſunder, and mending the joint) and their joined poles mutually attracting each other, attract nothing elſe at the joint (which being in the middle would become its equinoctial) but tranſmitting their virtues thro' each other, the pole Σ of the one fruſtum (Fig. 5.) entirely ſpends itſelf in ſtrengthening the ſimilar pole σ of the other fruſtum, by weakening the pole thereof *v*, and *vice verſâ*: And if their lengths ſhould be unequal, like the fruſta of Fig. 4. divided at *x*; the equinoctial would not be at *x*, where they were join'd together again, but always at *e*, the middle of their whole conjunct length, as it uſes to be in one entire loadſtone of the ſame bigneſs from pole to pole: For, he apprehends, if any loadſtone ſhould be wrought very tapering from one pole to the other, that the equinoctial could not be preciſely in the middle thereof; but according to what degree of tapering it is wrought to, be removed nearer to the great end: But for want of proper loadſtones, he could not try theſe things, nor yet the following on Fig. 7. which repreſents a loadſtone in the form of a right-angled parallelopipedon; its thickneſs one inch, its breadth *a f* ſix inches, its length *a c* ſeven inches or more; having its polarity not perfectly lengthwiſe in it, but ſomewhat oblique, as the ſhade-lines repreſent it. If from one of its ends *c d* be cut off the parallelopipedon b c d e an inch from the ſaid end, it will be an inch ſquare, and ſix inches long: He ſuppoſes this leſſer fruſtum would have its polarity changed, and its direction, inſtead of running from *e* ſomewhat towards *d*, would run from *e* towards *c* in the diagonal line *e c*, or in ſome line or other between the lines *e b* and *e c*. He alſo imagines, that if a cube were cut off, within a little time after, from one end, the polarity therein would be directed, as it was therein, while all the ſaid fruſta adhered together; but if the leſſer fruſtum *b c d e* ſhould long remain ſeparated from the whole ſtone, before the ſaid cube was cut off, that the polarity of the cube would be more or leſs fixt, and conform itſelf more or leſs to the direction of the line *e c*. However, this is certain, that if the two fruſta are joined together, as they ſtand directed Fig. 5, 6. with the north pole of one to the ſouth pole of the other, they aſſiſt each other in lifting iron: If joined (Fig 8.) with the ſouth pole of one againſt the ſouth pole of the other by

roelrepelling they reciprocally deſtroy each other's virtue, and likewiſe hinder each other's attraction at the north poles, which are not joined. If they be placed together, as in Fig. 9. tho' they endeavour to avoid each other; yet they do not deſtroy each other's virtue ſo much as in the preceeding caſe, nor yet at all, if there be a perfect contact: For, if this poſition of two magnets actually adhering would diminiſh their virtue, one part of the ſame loadſtone would deſtroy another part of itſelf; and in a very ſhort time there would be no ſuch thing as magnetiſm. In this poſition they mutually help each other's attraction; becauſe their polarities are directed the ſame way. If they be applied as in Fig. 10. with their ſides together, and their polarities contrarily directed; the north pole of the one (at either end) attracting the ſouth pole of the other; and the ſouth pole the north, they ſcarcely injure each other's virtue by lying together in that manner; but hinder each other from attracting other things by ſpending their virtue on themſelves.

He apprehends, that tho' a great magnet (he means of ſuch as are ſimilar in figure and ſpecific virtue) will lift conſiderably larger irons than a ſmall one; yet the ſmall one ſhall give to the ſame piece of ſteel (provided it be not too large for it to conquer) well nigh (if not altogether, as to ſenſe) as ſtrong a touch as the great one. And he has experienced, that if the ſmall one be ſpecifically much better, it will give the ſame ſmall piece of ſteel a conſiderably ſtronger touch than the great one can; tho' this laſt be capable of lifting, perhaps, three or four times as much as the ſmall one.

N. B. That if the great one be ſo ſtrong as to give the ſmall piece of ſteel ſo much virtue as it is capable of receiving (for, there is, he imagines, a *ne plus ultra*) that then ſhould the ſmall ſtone be ever ſo much better, it cannot mend the touch given by the great one.

Some write, that the loadſtone loſes none of its virtue by communicating it to ſteel or iron, of which Mr. *Savery* ſomewhat doubts the truth; eſpecially, if the ſtone be ſmall in proportion to the ſteel; in which caſe he has known touch'd ſteel loſe conſiderable virtue.

Steel is not only more receptive, but more retentive of magnetiſm than common iron; iron or ſteel hammer'd hard, more than the ſame while ſoft; but ſteel harden'd by quenching, more than either of them. Mr. *Savery* has obſerved, that ſteel cannot be ſeaſoned too hard for retention (nor, as he thinks, for reception) of magnetiſm; but may ſometimes warp

too

too crooked for its intended uſe; and muſt be made right again ſome way or other, either with a grinding ſtone, or (if that will not do) by heating it to a blue colour, and gently hammering it while hot; but if it can be helped, the temper for the blue colour is too ſoft.

Not only ſteel, or iron regularly touch'd, but likewiſe oblong iron, void of permanent virtue (ſo long as it has a tranſient virtue by poſition of either of its ends towards the pole of a loadſtone, large enough to affect it at a conſiderable diſtance) will perform all that any loadſtone can, tho' not with the ſame degree of power: For, either of them will attract, keep one piece of iron ſuſpended to another, and communicate ſome degree of permanent polarity to ſteel well hardened, as he has experienced, and likewiſe to an iron-wire.

The earth's central loadſtone has all the ſame virtues which others have, and no diſcovered ones beſides; and tho' we cannot approach it, yet it acts as others do at a proportionable diſtance: He has experienced, that it will keep a prepared ſixpenny (or with more difficulty a ten-penny) nail, ſuſpended to a prepared iron bar about $\frac{7}{8}$ of an inch ſquare, and 5 or 6 foot long, in an erect poſition with either of its ends downwards. He hung up the bar in a room by a loop of ſmall cord, faſtened at the upper end; he then carefully wiped the lower end of the bar, and the point of the nail, that there might be no duſt nor moiſture to prevent a good contact, taking care not to touch either of them with his finger, leſt perſpiration ſhould ſully them. Then holding the nail very erect under the bar, with its point upwards, he kept it cloſe to the bar, by holding only one finger under its head, for the ſpace of 30 or 40 ſeconds or more: Then he withdrew his finger very gently, and directly downwards, that the nail might not oſcillate; and if it fell off, he wiped its point as before, and tried it again at ſome other part of the plane at the bottom of the bar: For, he always found that it would more readily hang at one place than another; and uſually the middle was not ſo well as towards one of the edges or corners; and the ſucceſs better nigh one edge or corner than another. If both ends of the bar be equal in bigneſs, and the preparation of their ends ſimilar; it is indifferent which end is downward, if it have no permanent virtue: But if it have no more than an inchoate or imperfect degree of fixt polarity, one end will anſwer better, and the other worſe, in proportion to the degree of imperfect polarity it has.

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As ſoon as a ſoft iron bar, void of fixt polarity, is in an erect poſition, the higher part from the middle upward, becomes a north pole in north, or a ſouth pole in ſouth magnetic latitude: And *e contrà*, the lower part from the middle downward becomes a ſouth pole in north, and a north pole in ſouth latitude: But as ſoon as ever the bar is inverted, the polarity will be ſhifted in it, and in north latitude the end newly placed upward becomes the north pole, tho' it were a ſouth one immediately before; and the other end the ſouth pole, tho' it were its north one juſt before. The caſe is the ſame, if ſuch a bar be placed horizontally in or near the magnetical meridian: For, the end directed towards the north will conſtantly be a ſouth pole; and that which is directed towards the ſouth, a north pole: And as ſoon as ever the ends of the bar are ſhifted, the polarity, in reſpect of the bar, is alſo ſhifted (but not in reſpect of the earth) for which reaſon this virtue is called tranſient, and is communicated by the earth's central magnet, in ſuch manner as other loadſtones are ſaid to do.

Since in north latitude the north pole of the earth's central magnet not only communicates the virtue of a ſouth pole to that end of a bar neareſt it; but alſo helps it to lift iron, when neither the bar nor iron lifted has any permanent virtue; the ſaid magnet muſt, therefore, neceſſarily help the ſouth pole of any loadſtone or touched ſteel in lifting iron, but hinder its north pole. This agrees with common experience, the north pole of a magnet being unable to lift ſo much as its ſouth one in north latitude, but more in ſouth latitude.

This plainly ſhews the reaſon why an armed magnet, when both its poles are applied to a piece of iron, will lift ſeveral times as much as with either pole ſingle: For, the north pole of the magnet by ſending its virtue thro' the attracted iron, powerfully helps the ſouth pole of the ſaid magnet in attracting. Again, the ſtrengthen'd ſouth pole muſt more powerfully increaſe the attraction of the north pole: And ſince the poles mutually aſſiſt each other's attraction, with a power much greater than if they themſelves are not aſſiſted, the conjunct poles muſt neceſſarily lift at leaſt twice as much, as both of them can lift ſeparately. Mr. *Savery* once tried, and found the ſouth pole armed to lift 1125 grains, and both poles united 5760 grains with a little more difficulty: The ratio is about 1 to a little more than 5.

If a bar of iron or ſteel (not having the leaſt degree of fixt virtue) be placed in any poſition (except at or near a right angle with the magnetical line) it will not only for the present receive a transient polarity thereby; but if it remain in that manner long enough, the said polarity will gradually become fixt or permanent, more or less according to the hardness or softness of the bar, the time it has remained in that position, the angle its length forms with the magnetical line, and the proportion of the length thereof to its bigness; the longest (*cæteris paribus*) usually receiving most virtue: And sometimes when all these advantages concur, the polarity will be sensibly permanent in a little time, and not require a very long time to be rendered pretty strong.

By placing the said bar afterwards in the same position, only with its ends shifted, it will gradually lose its acquir'd magnetism, and at length have its polarity changed.

Mr. *Boyle* found one of his loadstones much impaired by lying long in a wrong position; Mr. *Savery* supposes he meant a repelling one, with its north pole towards the north pole of the earth. In like manner by applying one pole of a very small piece of loadstone to the same pole of a large one, he soon changed the polarity of the former; but could not effect it on a piece of any considerable bigness, tho' he tried some hours. Mr. *Savery* changed the polarity of a small frustum of loadstone suddenly, and without a contact; by holding one of its poles nigh the same pole of a piece of touch'd steel, much less than a common case-knife, at about $\frac{1}{8}$ of an inch distant, which would make the frustum leap to it. He frequently repeated these changes with the same frustum.

From this, and some of the preceeding experiments, Mr. *Savery* concludes, that if two parallelopiped loadstones, equal in magnitude, and similar in substance, figure and virtue, are placed close together, as in Fig. 8. with the north pole of the one directed against the same pole of the other; or with the south pole of the one against the south pole of the other; and the direction of their polarities magnetically east and west, they will, by repulsion reciprocally destroy each other in an equal, tho' long time: But if they are placed (in the same situation with respect to each other, *viz.* north pole against north pole, or south pole against south pole) with the direction of their polarities in or near the magnetical line, that stone (in north latitude) whose south pole stands directed to, or pretty much towards the attractive point of the earth's central magnet, receiving assistance therefrom, will not lose virtue so fast as the other; and consequently, never lose all its virtue, till it have

entirely

entirely deſtroyed the polarity of its antagoniſt, which it will do in leſs time, and afterwards communicate to it ſome polarity again, contrary to what it had at firſt.

Tho' fire deſtroy fixt magnetiſm in ſteel or iron; yet if they are ſet to cool in an erect poſition, or rather in the direction of the magnetical line, they will acquire more or leſs fixt virtue by the time they are cold; but eſpecially ſteel heated to a ſeaſoning height, and in that poſition cool'd ſuddenly under water, which Mr. *Savery* found to fix its polarity ſo thoroughly, as that with its north pole held downwards, it would attract the north end of a dial needle.

While a piece of iron of ſome magnitude is held at one pole of a load-ſtone, it will increaſe the attraction of the other pole thereof, and enable it to lift ſomewhat more.

If either pole of a magnet, ſufficiently large, toucheth one end of an oblong piece of ſteel (not too big and long for the magnet to act eaſily thereon) it will tranſmit its own virtue to the other end of the ſteel, which is fartheſt off, and make it a pole of its own kind; whilſt the end, which touches the ſtone, has virtue communicated to it from the contrary pole: But the virtue uſually is not ſo ſtrong in the end which is untouched, as in that which is; tho' Mr. *Savery* does not know but in ſome time it may acquire more; and the other loſe ſome, till the virtue in each end be nearly equal.

Not only a touched horizontal needle, which has permanent polarity, will endeavour to conform itſelf to the magnetical meridian; but likewiſe one that has no other than tranſient virtue, and is with the greateſt care freed from fixt magnetiſm (if made and uſed in the manner above-mentioned) will do ſo too; tho' with this difference, that which end ſoever happens to be placed neareſt towards the magnetical north will faintly turn thither; and if that end be not ſuffered to remain ſo too long; then the other end, placed neareſt to the north, will turn thither as the firſt did. In trying this experiment, Mr. *Savery* ſometimes found, that when the needle had reſted in the meridian only a few minutes, it acquired a perceptible permanent virtue; ſo that its other end would not be attracted to the magnetical north, unleſs it were placed conſiderably nearer thereto than he had placed the firſt end; and having ſtood in this manner for ſome time, it again loſt the ſaid inchoate permanency, and received polarity the contrary way. Once, whilſt Mr. *Savery* dined, and ſat but a little time after, he could not make the end which he left towards the ſouth to ſtand towards the north,

 unleſs

unleſs he placed it very true in the meridian: So that he was obliged to free it again from magnetiſm, before he could uſe it to repeat the ſame, or try the following experiment: For, the leaſt fixedneſs of polarity in the needle would more or leſs obſtruct both.

At the magnetical eaſt or weſt of the needle's pin, as exactly as he could gueſs it, he held at a conſiderable diſtance, either the ſouth pole of a loadſtone, or lower end (which is the ſouth pole) of an erect bar (both of them anſwered alike) and gradually approached it nearer in a direct line towards the pin, till it began to attract the needle, which he obſerved was as he expected at the ſouth end: He then changed the ends of the needle, and gradually approached the ſouth pole of a magnet as before, and conſtantly found it to attract that end, which was towards the ſouth; and the north pole of the magnet, would, after the ſame manner, attract the north end of the needle, when it had only tranſient virtue.

In his younger days Mr. *Savery* diverted himſelf with making an horizontal needle, and a dial box for it, one of his ſchool-fellows having a loadſtone. Before he could have the uſe of the ſtone, he often held the needle within its box, ſometimes with its intended ſouth end towards the bottom of a window bar (having obſerved one of his companions try it with his pocket needle, which was touched) and at other times he would hold the needle's north end at the top of the bar. He obſerved the needle which was hung very tender, to make vibrations at either end of the bar. He happened to ſet it down in the window at a good diſtance therefrom; and found the ſouth end more inclined to vibrate to the bottom of the bar than the north end; and obſerving it to have ſome virtue, he thought of increaſing it by taking the needle out of the box, and applying it to touch the bar with its proper ends. By this method alone it acquired ſuch a degree of polarity, as would conſtantly turn its proper end to the north, if it were kept trembling; but if he placed its contrary end to the bar, the polarity would be immediately changed. By this way of management he could give it but a faint verticity, which ſoon became more vigorous, when he got the uſe of the loadſtone, tho' ſmall and none of the beſt, and the needle ſoft iron. This was all he knew at that time of magnetiſm.

Having ſome few years before had a freſh inclination to make ſome magnetical experiments, amongſt other thoughts, the abovementioned occurred to him; namely, that iron, without any

any fixt polarity at all, might (if it moved tenderly enough) conform its ends to the magnetical meridian; which at length put him upon making ſuch needles, as are deſcribed above, either ſort of which anſwered his expectations as above-mentioned. Afterwards he touched one of the firſt ſort of needles (deſcribed *præcogn.* 7. whoſe length was 2 $\frac{5}{8}$ inches, and weight 1 $\frac{1}{2}$ ſcruple and 2 grains) on a piece of tranſient iron (made for armour to a magnet) which meaſured in inches as follows, *viz.* each ſide of the broad plated part about 1 $\frac{5}{8}$; the parallelopiped part in length 2; and in breadth (equal to its thickneſs) $\frac{1}{8}$: So that its whole length was full 3 inches $\frac{5}{8}$: Its weight was 3 ounces 2 ſcruples *Troy*. This held with its length directed in the magnetical line, communicated to the ſaid needle virtue enough to vibrate about 4 times in a minute. He held the needle, while touching, in a horizontal ſituation, with its north end directed towards the north; and placing its middle about the top of the iron, drew it along ſouthwards. Likewiſe placing its middle about the bottom of the ſaid iron, he drew it northward, that the ſouth end might be touch'd as well as the north. Afterwards he touch'd it the new way (to be mentioned anon) with the ſaid piece of armour, and a ſmall piece of tranſient iron, which made it vibrate about 6 times; and he believes it would have performed more vibrations, had the needle been hardened ſteel.

Having no other than a ſmall loadſtone of a very irregular ſhape, Mr. *Savery* was loth to diminiſh it enough to bring it into a tolerable figure to receive armour, but did only grind a little place plain at each pole, where he bound the armour on with thread. Its weight when naked was but 7 drachms, 2 ſcruples, 6 grains; its armed ſouth pole would only lift 7 drachms 1 $\frac{1}{2}$ ſcruple, 3 grains; which was a key. He conſidered, that ſince a larger ſtone of the ſame ſpecific virtue would lift more, it might poſſibly communicate more virtue than what his could do to the ſame piece of ſteel; but could not fail of doing ſo to a much larger piece; and having obſerved, that touch'd ſteel would communicate ſome virtue, as well as attract, he procured ſome ſteel-wire (the largeſt he could meet with) which having cut into equal pieces, and filed their ends as tranſverſely as poſſible, and very plain, he made a ſtandard with a plate of iron, into which he could but juſt thruſt the ſhorteſt; and filing all the reſt till they would but juſt enter the ſtandard, he reduced them nicely to the ſame length. Then having marked one end of each of them with the edge of a file, he tempered them very hard, and poliſh'd

them

them, ends and all, very bright. Each of them meaſured in length about 2.74 inches, and weighed 36 grains or more. With his loadſtone he touch'd 37 of them, one by one, making their markt ends their ſouth poles: He laid them ſide by ſide at about ½ an inch diſtance from each other on a board, with their marked ends towards the ſame edge thereof, and took care that they ſhould not touch one another, after they came from the ſtone, before they were all of them touch'd thereon. Then having thread and armour, made, as repreſented in Fig. 11. (one piece marked, which he applied to the marked ends of the wires) in readineſs, he ſpeedily thruſt them together into a bundle, and caſting the thread 2 or 3 times round them with his fingers he formed the bundle into a regular hexagon as ſoon as poſſible; and then bound them faſt from end to end, and bound faſt the armour: He took 37 wires, becauſe that number would form a regular hexagon at each end; as will likewiſe 19 or 7. Finding this artificial magnet exceed his natural one, he held the artificial in one hand, and the natural in the other; the north pole of the one againſt the ſouth pole of the other; and placing their armour on the middle of one of his wires, he drew the magnets aſunder; and ſo touch'd both ends of the wire at the ſame inſtant. In that manner he touched one by one a ſecond ſet of wires, which he managed like the firſt, and bound on the armour of the firſt ſet to the ſecond. The ſouth pole lifted a key, 2 ounces, 2 drachms, 2 ſcruples, 5 grains *Troy* weight. Both poles united would, with difficulty, lift the ſaid key with weights faſtened thereto, the whole, a pound *Troy*. He next tried with 19 wires, for which he made armour of a proportionable ſize; but that did not anſwer ſo well, he thought, as 37, tho' he repeated the touch. Afterwards he took 7, which he thought performed according to its quantity, as well as the 37: Therefore, he ever after uſed the number 7.

In the next place he thought of mending this way of touching, by placing all the 7, or more of them, with their marked ends towards the north in a long ſmall trench, whoſe depth was juſt fit for one of them, to keep it from rolling away, while he was touching it and its fellows: The north end of one touching the ſouth end of the other, and adhering by their magnetic virtue, he placed the two magnets, as before, at their conjunct middle (not letting them remain there a moment) and then inſtantly and ſpeedily drew one magnet to one end of the wires, and the other magnet to the other end of them; by which method he touched them, all at once, as it were; and as if they had

had been but one entire long wire. He found this way not only more expeditious, but more advantageous, giving all of them a ſtronger touch: But the wire at each end was not ſo ſtrongly touch'd as the reſt: Therefore, he placed more wires in the trench than he had occaſion for, and laid aſide thoſe at each end, whoſe virtue was weaker. One of theſe wires, when it was thus newly touch'd, would lift a prepared nail 4.75 inches long, weighing ſeven drachms and ſix or ſeven grains, that is, upwards of 426 grains *Troy*. The weight of the wire can be had in that of the nail 11.83 $\frac{1}{3}$ times. He placed all the ſeven ſeparately in the magnetical line for about two days; in which time all of them had loſt ſome virtue; yet one of them would with difficulty lift the aforeſaid nail, which it did ſomewhat eaſier juſt after the touch; and that which had loſt moſt virtue, would eaſily lift a nail of 4 $\frac{1}{5}$ inches long, weighing 306 grains.

Having ſuch ſucceſs, he procur'd ſeven round bars of ſteel to be made, of the ſame ſize from end to end: So that they would but juſt go thro' a hole, made on purpoſe in a plate of iron, and tried their lengths in a ſtandard as he did the others; and marked one end of each of them with the corner of a file in this manner, that he might be able to ſee the mark, when they were bound together, leſt any of them ſhould be placed with its end the wrong way. Their diameters were about $\frac{3}{8}$ of an inch, and their lengths 12 $\frac{1}{4}$ inches good meaſure. He harden'd and cleans'd them as he did the wires; but one of them happening to break by a fall in touching, he got it ſupplied; and for fear of ſuch another accident, he reduced them almoſt to a blue colour. He laid them one after another in a trench, planed for them in a long piece of wood about the depth of half their diameter, putting their mark'd ends all one way: He made a hole in the trench a few inches from one end of the piece of wood; and put a pin in it to keep the bars from ſliding to the ground, and rais'd the other end, till it was, as he conjectured, in the magnetical line. He then touch'd them with two of his magnets as before, and this he found the beſt way of all. When they were finiſh'd, and armed with proper armour, above half a year after the north pole lifted one pound *Troy*, and the ſouth pole conſiderably more. In making one of theſe he met with an odd accident: For, after he had begun to touch it, apprehending it was a ſmall matter bigger than the reſt, he attempted to mend it on a grinding ſtone, whoſe axes were directed about 14 or

15

15 degrees from eaſt towards north, and from weſt towards ſouth. He was not careful to keep its poles the proper way in grinding, but held the bar ſometimes a-croſs to the ſtone, which would make it jar; at other times with the north pole towards the north: Afterwards he touch'd it again with the reſt, but could not give it an attraction equal to that of the others. He happened to try with his dial-needle, whether the change of polarity was in the very middle of the bars, or nearer to one end than the other; and in this bar he found ſeveral polarities contrary to expectation; but how many he was not poſitive. As he held it erect, the bottom was a ſouth pole, further up no attraction, the pole changing a little higher (he thinks one third part of the bar's length) a ſtrong north pole, and about two third parts up a ſtrong ſouth pole, and at the top, a ſtrong north pole, the middle between each pole not attracting: Whether the jarring on the grind-ſtone, while held in a wrong poſition, was, as he ſuppoſes, the cauſe of this irregular virtue, or whether he might at firſt, by miſtake, touch it the contrary way, he could not poſitively aſſert; but all his care and labour would not help it by touching: For, as the virtue became ſtronger in the ends, ſo likewiſe did the polarities in the other parts of the bar. He thought firſt, that he would try to cure it by putting it over wood-coals in a horizontal poſition, with its intended ſouth pole directed towards the magnetical north; which he did, and kept it ſo till it became blue. Then he took it out of the fire, and cool'd it almoſt in the ſame poſition; for, he thinks the north pole thereof was elevated. He tried it without retouching, and found it perfectly cured, the polarity regular throughout, and (which he was ſurpris'd at) attracted full as ſtrongly as any of the reſt.

He next endeavoured to procure magnetiſm in ſteel, without the aſſiſtance of the magnet, only the earth's central one.

Finding his artificial magnets, rightly us'd, would communicate more virtue to other ſteel than they themſelves had; and obſerving that erect bars had ſome virtue from the earth's magnet; and having alſo experienced that iron, which had only tranſient virtue, would, when in an erect poſition, or in the magnetical line, give a ſmall degree of fix'd polarity he ordered nine ſteel bars to be made, 0.75 of an inch ſquare, and 16 inches long. Some of them happened to be a little leſs; the weight of the heavieſt, after it was finiſhed, was three pounds *Avoirdupois.* He made them pretty bright by grinding;

grinding; and filed their ends as plain as he could, and transverſe to their lengths, by means of a carpenter's ſquare; then marked one end of them; and when hardened, he ſcowered them bright, and poliſh'd their ends very well. He fitted a piece of armour for each end of one bar, and marked the piece, which was for the marked end of the bar, and bound both pieces of armour faſt to the ſame bar, one at each end: then ſtanding with his face towards the weſt, and holding the palm of his left hand upward, he placed therein one of the bars without armour, with its marked end northwards, and graſped it faſt in the middle, with his fingers on the weſt ſide, and the ball of his thumb on the eaſt ſide; where he likewiſe laid along his whole thumb to keep it ſteady: And ſo the upper part of the bar was open from end to end. Holding it thus, he rais'd the ſouth end thereof, till he gueſs'd it was in the magnetical line; and with his right hand holding the armed bar, with the poles of the armour downwards, and the marked end towards the north, depreſs'd to the magnetical line, he placed the pole of the upper armour about four or five inches from the top of the unarm'd bar, and as ſoon as ever it touch'd the bar, he began with the greateſt ſpeed poſſible to draw it downward, till he was paſt the middle; and from thence to the bottom gradually ſlower: When it was at the bottom he permitted it to reſt there about one or two ſeconds. After the ſame manner applying the pole of the lower armour to the unarmed bar about four or five inches from its bottom, he drew it upwards ſpeedily at firſt, ſlower when above the middle, letting it reſt a little at the top. Having upwards and downwards alternately repeated the touch on the ſame ſide of the bar, he touch'd the oppoſite ſide thereof, which was next his hand, in the ſame manner; and afterwards the two other ſides. Then holding the unarmed bar erect, he uſually obſerv'd if it had gained any fix'd polarity by holding his ſmall needle at the top and bottom of the bar: For, if it had acquired any virtue by the touch, it would attract the needle ſtronger at the ſame diſtance, when the marked end of the bar was held downwards, than when it was held upwards. If he found it had gained any ſenſible virtue, he took off the armour from the firſt bar, and bound it to the ſecond he had touch'd; and after the ſame manner touch'd the firſt bar with the ſecond, as he had touch'd the ſecond with the firſt. And when by trial with the compaſs-needle he found the armed bar had communicated more

virtue to the other than was in itſelf, he took off the armou[r] and bound it to that which was newly touched, and therewit[h] re-touched that which he had diſarmed. In a few repetitio[ns] of changing the armour from bar to bar, and touching th[e] weakeſt, he procur'd in both of them (without the aſſiſtan[ce] of any of the other 7) a fix'd polarity to ſuch a degree as th[at] the north pole, or unmarked end of either of them, he[ld] downward, would attract the north end of the needle, th[o'] much fainter than if the north-pole of the bar had been upwar[d]; and this poſition did not now change their polarities, b[ut] only weaken them: Therefore he now calls their virtue pe[r]fectly permanent. Four or five repetitions more increas[ed] their virtue to ſuch a degree, as that the ſouth pole of one [of] them would lift a ten-penny nail prepar'd; and after two [or] three repetitions more a common door-key of an iron box-lo[ck] (weighing one ounce and upwards of two ſcruples *Tro[y]*) not by the bow, but by its lower end, which was wroug[ht] ſomewhat globular and poliſh'd. In the laſt place he pr[o]cur'd a piece of inch deal, upwards of three inches broad, a[nd] ſeven or eight feet long; in the middle of which, at abo[ut] five or ſix inches from one end, he made a hole through wi[th] a large gimlet, into which he drove an iron or ſteel pin, who[se] length (beſides what went into the wood) was ſomewhat le[ss] than the thickneſs of one of the bars. Then he placed th[e] biggeſt bar on the ſaid board with its marked end cloſe to th[e] pin, and its length parallel to that of the board, and with a[n] awl made four ſmall holes in the board one of them on eac[h] ſide of the bar, about an inch from the bottom, and about th[e] thickneſs of a ſix-pence from its ſides; and the other tw[o] after the ſame manner, about an inch from the top. H[e] drove into them pins of large wire half an inch long, beſid[es] what was in the board. The pins were to keep the ba[rs] from ſliding out of their places in touching. Then removin[g] that, and placing any other bar between the ſaid pins, wi[th] its marked end cloſe againſt the great pin, he placed th[e] marked end of the ſaid biggeſt bar cloſe againſt the unmarke[d] end of the other, and made four holes on its ſides, and dro[ve] pins in them as before; and continued ſo to do, till the boa[rd] was full: It held half a dozen bars. He took care to pla[ce] the marked end of every bar, directed towards the great ir[on] pin, which was to keep them from ſliding down to the groun[d] when the other end of the board was elevated to ſtand in th[e] magnetical line. The board ſtanding with one end on th[e]
groun[d]

ground, and the other leaning againſt the wall, at the ſouth end of the room, he took the armed bar which had virtue, and placed the armour of its north pole about the middle of the higheſt bar, whoſe middle he could reach to (keeping the armour of the ſouth pole a little upon one ſide of the bars, juſt ſo far as he might be ſure not to touch them with that end) and then immediately drew it from thence downward to the bottom of the loweſt bar: After the ſame manner placing the armour of the ſouth pole on the middle of the loweſt bar (and holding the armed north pole on one ſide, that it might not touch) he drew it upward to the top of the higheſt bar, whoſe top he could reach. And if the end of any bar were a little under that which it reſted againſt, he uſually put a ſizeable chip under it, that the armour might not hitch in drawing it over the places of their contacts. He uſually touch'd the bars on all their four ſides; then took out the loweſt (and letting the reſt ſlide gently down to the iron pin) placed it at top, that thoſe which were firſt at the top, might in their turns take their places in the middle, and be well touch'd. He commonly reſted at the end of each bar in drawing (as in the ſingle bar above mentioned) when he found thoſe on the board conſiderably ſtronger than his armed one, he took out that which he thought attracted beſt, and bound the armour to it, putting the other in its room. After ſeveral repeated touchings, the largeſt bar weighing three pound *Averdupois*, would be ſuſpended by its north pole to the ſouth pole of one of the beſt of the others. They did not lift one another, nor attract ſo well when their ends were applied centrally, as when applied to one another (as repreſented Fig. 13.) near their oppoſite corners. The line *m* in the end of each bar repreſents the manner he us'd to mark their intended ſouth poles. With one of theſe armed he touch'd a ſmall ſquare bar of ſteel (placed between two of the large ones) whoſe length was 2.156 inches, and the breadth of each ſide 0.27 or ſomewhat more than $\frac{1}{4}$ of an inch, the weight five drachms four grains (*i. e.* 304 grains) it would afterwards lift an iron 5 $\frac{1}{4}$ inches long, weighing four ounces, one drachm, one ſcruple, or 2000 grains. 304 can be had 6.578 times in 2000. So that it lifted above 6 $\frac{1}{2}$ times its own weight. With this ſmall bar naked, he touch'd a ſmall dial-needle made of ſteel (the ſocket in the middle was alſo ſteel, and not braſs, as uſual) he ſeaſoned it very hard and cleans'd it well, and very carefully, leſt he ſhould break it, becauſe ſo hard. It weigh'd not quite four grains, and lifted two prepar'd ſix-penny nails, one at each end, while it was held in a horizontal poſition, with its ſouth pole towards the north. It alſo lifted a key by the bow, as it was held perpendicularly with its ſouth pole downwards, whoſe weight was one drachm, two ſcruples, 15 grains good weight (*i. e.* 115 grains or better) Wherefore, ſince the needle weigh'd leſs than four grains, which is the 29th part of 116, we may reckon it lifted full 29 times its own weight by the force of one pole, the key having no permanent virtue before.

Mr. *Savery* never ſaw this communication of magnetiſm outdone, by the load-ſtone itſelf, as it is commonly us'd: But what a good one would do, us'd as he did the ſteel, he does not know; but doubts, unleſs ſteel could be made better than it uſually is, a ſtronger degree of attraction therein is ſcarce to be hoped for from the uſe of the beſt of load-ſtones.

He uſually found the attractive power in ſquare bars, cut plain over, tranſverſe to their lengths, to be ſtrongeſt, not in the middle of their ends; but much nearer to their corners or ſides, and to be greater at one corner or ſide than another; and this not only in ſuch as are of touch'd ſteel, but in iron ones that have no polarity, but from their poſition. He obſerv'd the ſame in round bars, if their ends be not convex.

In ſome of his large ſteel bars (as alſo in ſome of the round bars) he found the north pole ſtrongeſt, in others, the ſouth. He does not know what may be the cauſe thereof. For, tho' he touch'd the weaker end twice as often as the ſtronger one, it would ſtill continue to be ſo, when the ſtrongeſt had been well touch'd before. He imagines it may be owing to ſome inequality of the ſteel, occaſioned by the different degree of heat, taken at the forging; different degree of heat when the ſmith deſiſted hammering; different degrees of heat in making the iron into ſteel, or quantity of iron that is made uſe of in doing it; fineneſs of the iron which the ſteel was made of; ſome ſmall difference in ſize, or difference in tempering; it being almoſt impoſſible to make both ends equally hard; but that both ends of his might be ſo, he had a fire made long enough to heat their whole length at one and the ſame time. He left ſeveral of the bars on the board on which they were touch'd; and in the ſame poſition to one another, as well as to the earth, for ſome months, in order

order to ſee whether they would loſe any of their virtue; but if they did, it was ſo little, that he could not be ſure of it.

He likewiſe tried, whether what he mentioned above concerning load-ſtones would hold in five or ſix bars, regularly touch'd and placed in the ſame manner with reſpect to one another; and he found that at ſome of the joinings it anſwer'd pretty well, but not ſo well at others; commonly beſt at the two extreme joints, and worſe at the middle ones. When he held the dial-needle at a good diſtance from the bars (perhaps ſix or eight inches) the attraction was more regular; and the different poles of the two bars at their contact was not ſo eaſily diſcernible; but when he held it within two or three inches diſtance, both the poles diſcovered themſelves more or leſs at every joint: The cauſe probably may be the want of a better contact; the ends of the bars not being true planes; or it may be partly owing to their conjunct length (tho' he cannot ſee how that ſhould cauſe it) or ſome irregularity in the virtue of each particular bar: For, it has been obſerved, that very oblong iron, as wire, is capable of having a north pole in both ends, and a ſouth one in its middle; or as his round bar above-mentioned, ſeveral polarities in no greater length than about one foot. His bars were not made of *German*, but more ordinary ſteel, of about four pence *per* pound.

The Uſe of the Bile *in the* Animal Oeconomy, *founded on an Obſervation of a Wound in the* Gall-bladder, *by Dr.* Alexander Stuart. Phil. Tranſ. N° 414. p. 341.

ONE Mr. *Menzies* was wounded about 3 o'clock in the morning *Oct.* 30. 1728, and died *Nov.* 5th in the morning (being the ſeventh day after he was wounded) in the fortieth year of his age.

Dr. *Stuart* was call'd *Nov.* 2. about 11 o'clock in the forenoon, being the fourth day after the patient receiv'd the wound. The ſurgeons who attended him from the beginning, being preſent, told the Dr. that his belly was diſtended, as the Dr. then ſaw it, from the beginning, giving the appearance of a tympany or aſcites; and it continued at the ſame pitch of diſtention, neither diminiſh'd, nor ſenſibly increas'd, to the time of his death. The patient had no *ructus* nor *flatus* upwards or downwards, nor *borborygmi*, notwithſtanding this diſtenſion of the belly. He never went once to ſtool after

after he received the wound, tho' pretty ſtrong purgatives and ſeveral clyſters had been given for the three days before the Dr. came; and tho' no opiate (which might have been ſuppoſed to have retarded their operation) had hitherto been exhibited: Nor had thoſe purgatives or clyſters the Dr. ordered afterwards, the leaſt effect; and yet the patient took what was thought a ſufficient quantity of drink and liquid food. He never ſlept, or but very little by ſhort ſlumbers, of about half an hour, or an hour at longeſt; and that very rarely, notwithſtanding pretty large doſes of opiates were given in order to procure reſt, after the Dr. came. The wound in the integuments never digeſted in the uſual manner; but looked flaccid and pale, almoſt without any *pus*. The urine in very ſmall quantity, at moſt 2 or 3 ſpoonfuls at a time, clear but yellow, as if ſlightly tinged with ſaffron, and without ſediment. His pulſe was full, ſtrong and even, but not quick. No feveriſh heat to be felt in the ſkin on any part of the body. His tongue not hard, rough or black, as in a fever, but of its natural colour, with a ſilky drineſs, and very little ſaliva. He was not in the leaſt delirious, from the beginning to the time of his death. He had ſome ſlight fits of the hickup the ſecond day after the Dr. ſaw him, and ſome few reachings to vomit; ſome intermiſſions in his pulſe; ſometimes 1 in 10, 15, 20, or 30, a day before his death.

Upon opening the body the *abdomen* appeared diſtended as in a tympany, or *aſcites*, and the ſkin of the belly in ſeveral places tinged yellow as ſaffron. A triangular wound appeared about 2 inches on the right ſide of the navel, the direction ſlanting upwards, obliquely thro' the integuments: The belly being opened, diſcovered the wound to have penetrated thro' the *peritonæum*; and the ſword had ſlanted upwards from thence along the *omentum*, grazing ſlightly upon it, being ſuperficially ruffled, but ſo as hardly to be perceivable. A ſmall triangular wound appeared in the bottom of the gall-bladder, which had penetrated thro' the membranes into its cavity, but had no where wounded the liver, nor any of the neighbouring parts. The gall-bladder was flaccid or collapſed, containing only a few drops of gall, which by ſlightly preſſing the *cyſtis*, flowed out thro' the wound into the cavity of the *abdomen*. The guts, throughout their whole tract, being diſtended in ſuch a manner as to be triple the extent of their natural diameters, ſeemed to fill the whole cavity of the *abdomen*; ſo as to give the outward appearance of a tympany or *aſcites*; but this diſtenſion diſappeared, and the guts collapſed, upon making ſeve-

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ral punctures with a lancet in their ſides, to give vent to the air. The reſt of the cavity of the *abdomen*, which was not cloſely filled up by the diſtended guts, contained a groſs muddy water or ſerum, intenſely yellow, or highly tinged with gall, to the quantity of three quarts, as the Dr. could conjecture without meaſuring it. All the guts, and contents of the *abdomen*, were highly tinged with this yellow liquor; but no other part of the body, out of the contact of this liquor, had the leaſt appearance of it. No inflammation appeared in any part of the guts, or in any of the *viſcera*, which were all ſound and healthy. The obliquity of the wound thro' the integuments, muſcles and *peritonæum*, made it impoſſible for the external air to enter into the cavity of the *abdomen* that way.

In order to make ſome uſe of this caſe, it muſt be obſerved, that the great *apparatus* in the liver and ſpleen, two of the largeſt *viſcera* in the body, confeſſedly deſigned for the preparation and ſecretion of the bile, and the place of the inteſtines, into which it is immediately depoſited, afford, indeed, a ſtrong argument for the univerſal uſe of it in the animal œconomy; but do not directly point out what, or how many theſe uſes are, about which there has been a great variety of opinions.

But this ſingular caſe, which muſt have happened very rarely, if ever before (in which none of the *viſcera*, but the gall-bladder was wounded, and thereby nothing but the gall loſt or miſplaced) by ſhewing how many functions in the animal œconomy were impaired or deſtroyed by the ſole want of it, does at the ſame time point out its uſe and neceſſity towards health, or the perfection of theſe functions; and may probably lead to ſome indications of cure, in caſes wherein it is known to be deficient, faulty or redundant.

There was no other apparent or aſſignable cauſe of theſe various ſymptoms during the patient's life, nor of his death, nor of thoſe ſeveral appearances in the body upon diſſection, but this wound in the gall-bladder: And as this wound could not affect any of the parts, nor produce theſe ſymptoms in any other ſenſe than as it gave vent to the gall into the cavity of the *abdomen*, and deprived the cavity of the inteſtines and the blood thereof; therefore, from this loſs and miſplacing of the gall, all theſe ſymptoms and appearances may juſtly be concluded to ariſe, and the Dr. thinks may be accounted for from that cauſe in the following manner.

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1. The *abdomen* was from the beginning diſtended, as in a tympany or *aſcites*, and the guts appeared inflated to their utmoſt diameters.

It is true, that this inflation and diſtenſion happens to moſt people a few hours before death, and to all ſoon after, and ariſes from the ſpring, or elaſticity of the included air, getting the better of its antagoniſt ſpring, the elaſticity of the muſcular fibres of the ſtomach and guts, which have no longer the aſſiſtance of the blood and ſpirits to contract them, and keep up their periſtaltic motion. But the inflation and diſtenſion, here ſpoken of, happened ſeveral days before death, and as the Dr. was told, the very next day after he received the wound, tho' the pulſe was apparently ſtrong and equal; and conſequently, a defect of blood and ſpirits was not to be ſuſpected; and therefore, it may be juſtly concluded, that the influx of the gall into the cavity of the guts is as neceſſary to the ſtrength of their contraction, and perfection of their periſtaltic motion, as that of the blood and ſpirits into their ſides; and that theſe three are the conjunct cauſes of this motion in health, which would be defective by the total want of any of them. Hence it is, that in ſchirroſities of the liver, where the ſecretion, and conſequently the excretion of the bile is more or leſs defective; and in the jaundice, where by ſome obſtruction in the biliary ducts after ſecretion, a part of it is forced back, and regurgitates into the blood, and very little of it is thrown into the guts; we obſerve an uncommon diſtenſion in the guts and coſtiveneſs; which, if the caſe prove incurable, terminates in an *aſcites* or dropſy in the cavity of the *abdomen*.

It may alſo be worth while to enquire, whether what is commonly called an hyſteric, or nervous colic, generally attended with a leſſer degree of ſuch like diſtenſions, with *flatus*'s and *borborygmi*; wherein the animal ſpirits are ſo much and only blamed does not partly ariſe from a ſluggiſh ſecretion and excretion of the bile, occaſioning a defect in its quantity; or from its acrimony and great viſcoſity, occaſioned by its ſtagnation in the gall-bladder; or from both theſe together, as well as from a defective or unequal diſtribution of the blood and ſpirits in the parts affected. In confirmation of this, the Dr. has generally obſerved, that at ſome time or other in the cure, a conſiderable evacuation of porraceous viſcid bile, brought away, either by art or nature, as well as a great profuſion of pale urine, compleated the cure for that time. The vomiting of porraceous bile, very common in ſuch caſes, proves the ſame; and

and the Dr. believes, it is generally allow'd, that the ferruginous, porraceous, and black colour of the bile is owing to shorter or longer stagnations of it, chiefly in the gall-bladder; which the sedentary life of such as are subject to these colics, will sufficiently account for, even if there was no other error in their way of living; and whoever has observed the high yellow colour and contents of the urine in a jaundice, arising from a redundancy of bile in the blood, will readily acknowledge, that an uncommon watery paleness in the urine, where no more than the usual quantity of fluids has been taken down to dilute it, shews a defect of bile in the blood; and the Dr. believes it easy to account for the *flatus*'s, *borborygmi*, inversions of the peristaltic motion, the *pila histerica*, palpitations, *scotomia*, *vertigo*, and other symptoms of these distempers, which are called nervous and hysteric from the same cause: And hence it is, that bitters and steel, known *deobstruents* of the liver, and correctors of the bile, with gentle chologogues in very small doses, are of so much use in such cases; tho' it be certainly true, that all strong stimulating purgatives are very hurtful and improper.

2. There were no *ructus*'s, or *flatus*'s upwards or downwards, nor *borborygmi*, notwithstanding this distension of the belly and inflation of the guts.

This, the Dr. thinks, shews very plainly, that the guts had lost all motion, and were become paralytic by the total want of the bile only, as much as if their nerves had been entirely obstructed: For, had any motion remained in them, whether the natural and regular peristaltic motion, or a preternatural convulsive one, their contraction either way, would have propelled the included air from one place to another, and occasioned *borborygmi*; or expelled a part of it upwards or downwards, when nature had so much need of it to relieve the distended guts, and art had contributed to that intention by clysters and purgatives: Which serves to illustrate what has been said above, concerning the defective and convulsive motion of the guts in hysteric cases; where, thro' a defect in the quantity or quality of the bile; or from both these, the motion of the guts becomes defective, irregular or convulsive; but is not entirely lost thro' a total want of it, as in this case.

3. The patient never went to stool after he received the wound; and the strongest purgatives and clysters had no effect.

This likewise seems to be owing to the want, or total loss of the peristaltic motion; and plainly shews, that the strongest purging *ſtimulus* has not the power to reſtore it, without the aſſiſtance of the gall: For, had it been in any degree reſtored, the belly would have fallen proportionably, and ſome diſcharge of what was lodged in the firſt paſſages would have followed. If then the power of purgatives depends upon the co-operation of the bile, it will follow, that where it is moſt active or redundant, their operation will be, *cæteris paribus*, greateſt; and where it is unactive or deficient in quantity, they will have proportionably a leſs effect. Tho' it be true, that a quantity, or morbid acrimony of the bile, by a too ſtrong and violent irritation, will bring the inteſtines into ſuch ſpaſms, as to ſtop all evacuation by ſtool; and the ſtrongeſt purging *ſtimulus* added thereto, does only increaſe the ſpaſms and coſtiveneſs; as in bilious colics, which are always attended with exceeding coſtiveneſs, unconquerable by the ſtrongeſt purgatives, if they be not joined with opiats, to allay the ſpaſms, and blunt the acrimony of the bile. The patient took what was thought a ſufficient quantity of liquid food and drink; but if the elaſticity of the guts and their periſtaltic motion were loſt, it is eaſy to prove that none of his food or drink could enter the lacteals for want of the periſtaltic motion; and therefore that he died ſtarved. All that have ſeen live diſſections, which are intended to ſhew the nature of the periſtaltic motion, and the courſe of the lacteals, muſt have obſerved, that the guts have an alternate *ſyſtole* and *diaſtole*, or contraction and dilatation, called the periſtaltic motion, the ſuperior ſection contracting itſelf, while the immediately inferior ſection is dilated; and this motion is carried on in ſeveral parts of the guts at the ſame time; and the contracting part, by expelling the blood and chyle out of its ſides, in its contraction, looks pale, while the parts dilated look florid, and the veſſels full of blood and chyle.

Now the part contracting muſt neceſſarily force the chyle from the groſſer parts of the aliments towards the inner ſurface of the guts; where the perforated capillary extremities of the lacteals in the villous coat are ready to admit, or rather to abſorb it by attraction, as far as the larger and viſible branches of the lacteals on the coats of the guts, into which it eaſily flows in the time of dilatation or diaſtole, which at that time expands or unfolds theſe veſſels for its eaſy reception; from which it is farther propell'd by the next ſyſtole, or contraction, into the primary or firſt order of the lacteals in the meſentery; and by the ſame repeated impulſes of the contracting ſections of the guts, is forced farther thro' the ſecond order of lacteals

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in the meſentery, into the *receptaculum commune*, and thoracic duct; aſſiſted by valves, and promoted by the inceſſant motion of the muſcles, and of all the contents of the *abdomen* and *thorax* in reſpiration, it is at length thrown into the ſubclavian vein for a perpetual recruit of the blood in a healthy ſtate: But if the muſcular fibres of the guts have loſt their periſtaltic motion, as in this caſe, then the expreſſion, abſorption and progreſs of the chyle deſcribed cannot ſucceed, the blood muſt be deprived of its recruit, and the perſon die ſtarved; which ſeems to have been this patient's caſe, and will ſufficiently account for the reſt of the ſymptoms above recited. 1. His want of ſleep, and the inefficacy of *opium* to procure it, might be owing to a want of recruit of chyle in the blood: As we ſee that ſuch as live ſparingly ſleep very little; and ſuch as feed plentifully, require by ſo much a greater number of hours to ſleep; and in all chronical caſes, where the body ceaſes to be nouriſhed, the ſleep alſo fails, and opiats have but little efficacy: Whereas in children, where a great part of their food goes towards both nouriſhment and growth, the greater part of their time is ſpent in ſleep. It may, indeed, ſeem difficult to conceive how a want of reſt ſhould enſue ſo ſoon after the accident. But conſidering that the loſs of one meal in a day, eſpecially of ſupper, to ſuch as have been accuſtomed to ſup, has occaſioned fewer hours reſt in the following night, it will follow, that ſuch perſons require at leaſt ſome ſmall recruit once in 6 or 7 hours, in order to reſt their uſual number of hours; and therefore in this patient's caſe, where all recruit muſt have ceaſed ſoon after the accident, he might be ſenſible of the impairing of his reſt in 6 or 7 hours after it; and thoſe about him might well obſerve the increaſe of that ſymptom, at leaſt in the following night.

Another difficulty ariſes from the obſervation of ſwallows, tortoiſes, *&c.* who ſleep moſt in winter, when they eat and drink nothing. In anſwer to which, there ſeems to be no parity between the natural conſtitution of their blood and humours, and that of men: To theſe and ſuch like animals, with regard to recruit and nouriſhment, action and reſt, the ſpring and ſummer are as one day, and the winter as one night; and their blood and humours ſeem to be adapted, not only to bear, but even to require ſuch long periods of reſt and action. And probably there is as little parity between the craſis and conſtitution of the blood and humours of a healthy perſon, and of thoſe in ſoporous and cataleptic diſeaſes, who are reported

ported to have ſlept for weeks or months without any kind of food: And therefore, where the craſis and conſiſtence of the blood and ſpirits are nearly the ſame, that is, *cæteris paribus*, he, who feeds and is nouriſhed moſt, will ſleep longeſt, and *è contra*. The poſition here advanced is farther confirmed by the inefficacy of the opiates given, they being capable of entering into the blood thro' the pores of the ſtomach in contact with them; by which quick paſſage they have been obſerved to procure reſt ſoon after they have been applied outwardly, or taken down into the ſtomach, as in this caſe they may juſtly be ſuppoſed to have done; tho' for the reaſons above-mentiond, neither they nor any thing elſe could paſs by the lacteals: But as the aliments could not paſs that way, *viz.* by the pores of the ſtomach, nor by the lacteals into the blood, there could be no recruit nor nouriſhment; and therefore, tho' the opiates enter'd into the blood by the pores of the ſtomach in contact with them, they could not procure reſt. Thus it would ſeem probable, that opiats produce their effect by detaining the chyle crude longer than uſual in the maſs of blood; and thereby prolong ſleep beyond the uſual time; and that they are ineffectual, where there is no chyle in the blood to be detained. But their power of retarding or ſuppreſſing all or moſt of the ſecretions and excretions; their palling or obtunding the appetite; their enabling one to faſt long, and ſupporting one in journeys and labour for a long time without food (effects well known to the *Turks* and *Aſiatics* in their journeys thro' deſerts, *&c.*) Theſe and ſome other known effects of *opium*, very much favour this opinion. 2. The want of *pus* in the wound was probably owing to a want of recruit of chyle in the blood; and the flabbineſs and paleneſs of its lips, to a ſhrinking of the parts for want of daily nouriſhment. 3. The ſmall quantity of urine was probably owing to a want of recruit of fluids from the firſt paſſages: For, theſe in a healthy ſtate find their way to the urinary paſſages very ſoon. The ſlight tincture of yellow, which it had, muſt have been from the bile ſpilt in the *abdomen*, and filtrated thro' the duplicature of the *peritonæum*, and bottom of the bladder: For, it could not be ſuppoſed to derive its colour from the blood, into which no bile could now enter by the common way. 4. The want of *ſaliva* and the ſilky drineſs of the tongue, ſeem to have been owing to the ſame cauſe, namely, a want of recruit of fluids in the blood, and a loſs of ſo much of them as fell into the *abdomen*. 5. If it be ſuppoſed that ſuch a ſmall wound thro' the integuments

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and muscles of the *abdomen* and *peritonæum*, was capable of producing a fever; then the patient's not having any symptoms of a fever, must be owing to a total defect of bile and chyle in the blood, none of which could enter the lacteals for want of the peristaltic motion, as has been said. Lastly, the few fits of hickup, reachings to vomit, and intermissions in the pulse in declining and dying persons, seem to arise not only from a defect, and therefore, an unequal distribution of the blood and spirits, but chiefly from the corruption and irritating acrimony of them, as the immediate cause of death in this and most other cases. Which shall be farther explained anon.

Here it may very reasonably be objected, that the *ductus hepaticus* would carry a sufficiency of bile, for the uses of the animal œconomy, into the cavity of the intestines, tho' none came by the *ductus cysticus*, and nature seems to have provided the *ductus hepaticus* for this purpose, that if any obstruction or defect should happen in any of these secretory channels, the secretion and excretion might go on, for the benefit of the œconomy, in the other; as nature has provided two kidneys, and double organs of sense for the same reason: But the effect will not be the same in a wound, which is the reverse of an obstruction; because by a perpetual evacuation thro' it, such a revulsion and derivation is made, as drains and deficcates all the neighbouring parts, and either lessens or entirely frustrates the secretion and excretion by them: And this we find to be true, where the secretory organs and ducts, concerned in the different secretions, lie at a great distance from one another; as in the *diabetes* we generally observe a very great deficcation of the salival glands, a defect of *saliva*, and perpetual thirst; and sweating and looseness lessen the secretion by urine; an issue drains and emaciates the neighbouring parts; and it is mechanically demonstrated by *Bellini*, that the flux of blood and of all the humours, will be most and strongest towards the part where the resistence is taken off, as in bleeding; to which this perpetual flux of bile thro' the wounded gall-bladder seems to have a great affinity; and therefore would probably promote the afflux of blood and secretion of the bile so much and so strongly towards the vessels, glands and secretory ducts, leading to the *cystis*, as very much to lessen, or entirely hinder the secretion by the *ductus hepaticus* into the guts by that channel.

Another objection is, that as the guts and other contents, and even the muscles and integuments of the lower belly, were highly tinged by the bile, it is probable that some of it had

got

got into the cavity of the guts, where it might by its *ſtimulus* keep up the periſtaltic motion, and by the lacteals get into the blood, as ſome of it got into the bladder in that manner, and tinged the urine. It is not unlikely that this might happen, when the bile came to be very redundant in the cavity; but in paſſing thro' the interſtices of the veſſels and fibres of the guts, as thro' a filtre, the groſſer, ſaline and ſulphureous particles of it, which are the moſt pungent and active parts, muſt have been left behind; which the muddy thickneſs as well as deepneſs of the colour, found in the cavity of the *abdomen*, compared with the tranſparent clearneſs of the urine, of a much lighter yellow colour, without ſediment, ſeems to prove: And it is not likely that ſuch a ſmall quantity of filtrated bile, as may be ſuppoſed to have paſſed that way, deprived of all its active particles, could either as to quantity or quality be ſufficient to aſſiſt in any function of the animal œconomy: And in fact, if any paſſed that way, it appeared plainly inſufficient to promote the contraction and periſtaltic motion of the guts, which continued preternaturally diſtended, from the beginning to the time of the patient's death.

It has alſo been objected, that an animal, that dies ſtarv'd, dies delirious and feveriſh; the experiment having been made on cats and dogs: And therefore this patient, who had no fever, nor delirium of any kind, cannot be ſuppoſed to have died ſtarved. In anſwer to this, the Dr. will not diſpute theſe facts, eſpecially the experiments upon cats and dogs, tho' he has not made any himſelf, nor does he remember to have had any juſt or accurate account of the ſymptoms of ſuch as have died of hunger and thirſt, in ſieges, and at ſea; tho' there have been ſeveral inſtances; and no notice, that the Dr. knows of, has been taken of their having died mad, delirious or feveriſh, tho' theſe ſymptoms are ſo remarkable and affecting. But ſuppoſing theſe facts, theſe caſes will differ very much from this before us: For, an animal ſtarved to death purely for want of food, has the gall flowing continually into the cavity of the inteſtines, unmixt and undiluted with chyle, and from thence by the lacteals into the blood: So that in a few days this acrimonious juice muſt become more redundant there, than any other humour; which joined with the conſtant attrition of the globules in circulation, muſt ſoon render the blood very acrimonious, rancid and alcaline; that is, muſt reduce the whole to a maſs of putrefaction, capable of ſtimulating the brain and nerves; ſo as to produce a fever, delirium, or madneſs: But in the caſe under conſideration

tion, no gall could enter into the blood: And therefore, this degree of putrefaction, and its effects, could not happen; tho' it must be owned, that thro' a want of recruit and dilution, a lower degree of putrefaction of the blood and humours must have followed, even in this case, from the continual attrition in circulation; such at least as was sufficient to render the whole mass in a few days unfit for any of the uses in the animal œconomy; and therefore, may be justly supposed to have been the immediate cause of death: For, all the passive principles, or materials of putrefaction, being actually in the substance of the blood, and all the active principles of heat and attrition being at work upon it to produce this effect, it could not fail to be brought about in a few days; and the same would happen to all animals, if what is effete, corrupted or altered, so as to be unfit for the use of the animal, were not continually carried off, by the emunctories, and a fresh recruit daily supplied from the *primæ viæ*; which evacuations and supply being kept up in their due quantity and proportion, do effectually prevent all putrefaction and acrimony, and keep the blood and humours in their natural temperature. It is not then a defect in the quantity of fluids that kills an animal in fasting, but a poisonous acrimony, which the blood and humours naturally contract, for want of a fresh recruit and equal evacuation. Thus in chronical distempers, where the patient appears extenuated and exhausted, the quantity of the fluids is certainly very small, yet sufficient to maintain life for some months or years, being kept in some degree of sweetness or proper temperature, by a certain proportion of recruit and evacuation: But where the recruit is entirely withdrawn, the evacuations will be proportionably lessened: And therefore, the quantity of fluids may remain much the same, but the quality will alter, and putrefaction, for the reasons above-assigned, must take place, and be the immediate cause of death, even long before the mass of fluids can be much diminished in quantity, as in the case before us; which leads to the answer of another difficulty, *viz.*

How the pulse should continue full, strong, and equal for several days, while the patient was in a starving condition, and the blood had no recruit from the *primæ viæ*. This, it is true, would be very unaccountable, if the waste of the blood and humours were supposed to continue at the same height, as before the accident, and the evacuations by the emunctories were the same as in perfect health. In this manner the contents of the blood-vessels would be soon wasted and exhausted. But *Sanctorius*'s *rius*'s obſervations and experiments ſhew, that the daily recruits and evacuations keep pace with each other, and are nearly equal in 24 hours in a healthy ſtate: And therefore, where the recruits are plentiful, the evacuations will be equally ſo; and where thoſe are ſparing, the evacuations are ſmall; or where the balance is caſt too much on either ſide, ſome indiſpoſition or diſtemper muſt follow. There is no exception from this rule, but in children, a part of whoſe nouriſhment goes to accretion; therefore in the caſe before us, the recruit being entirely withdrawn, the evacuations muſt have been little, or next to nothing: And therefore, the quantity of the blood and circulating humours would remain much the ſame, and keep up the fullneſs, ſtrength and equality of the pulſe for ſeveral days, till the critical putrefaction and colliquation of the blood, above-mentioned, on the fifth or ſixth day, rendered it unfit for a regular circulation, and produced intermiſſions in the pulſe, reachings to vomit, and hickup; all of them being local convulſions, and the effects of corruption, acrimony, irritation, and an unequal diſtribution of the fluids, which terminated in death the beginning of the ſeventh day.

The ſum of what has been ſaid is, that in this caſe, very little, if any, bile enter'd into the inteſtines; and that ineffectual; and none at all into the blood. And as there was no apparent defect in any part of the body, nor any wound that could have been either dangerous or deadly, in any other reſpect than as it gave occaſion to the loſs and miſplacing of the gall; it is therefore evident, that all the ſymptoms, and the patient's death, were entirely owing to the loſs of this uſeful juice; which it ſeems is ſo neceſſary to all parts of the animal œconomy, that this perſon could not live ſix days without it.

The practical inferences, that ſeem to flow by neceſſary conſequences from this obſervation, are. 1. That the periſtaltic motion of the inteſtines is as much owing to the influx of the bile into their cavity, as to the influx of the animal ſpirits and blood into their ſides; and therefore, that the bile is to be looked upon as one of the prime movers in the animal œconomy, by which the elaſtic ſprings of the natural motions, to wit, the muſcular fibres of the guts are ſet to work; upon whoſe motion all the ſubſequent vital and animal motions do ſo far depend, that none of them can be long in perfection where it is imperfect, nor ſubſiſt many days where

it

it is entirely wanting. 2. This prime motion is entirely loſt by a total want of bile; proves ſluggiſh by a defect in its quantity; becomes irregular or convulſive by a great redundancy or morbid acrimony of it. From whence ſeveral diſtempers, that are call'd nervous, may ariſe, and are more likely to be cur'd by correcting and evacuating the redundant or faulty bile, and removing obſtructions in the liver, than by moſt medicines taken from the common claſs of nervines. 3. That the efficacy of purgatives depends upon the co-operation of the bile. And therefore it is probable, that the difference of conſtitutions, at equal ages, with reſpect to purgatives, depends more upon the quantity and quality of the bile, than on the bulk or weight of the body, quantity of the blood, or other circulating humours. 4. It alſo appears, that the nouriſhment and accretion of the body do in ſome meaſure depend upon a due quantity and proper quality of this juice, without which the blood and circulating humours could not be recruited from the *primæ viæ*: And therefore, that defects in it may frequently be the cauſe of a *maraſmus*, or waſte of the body, where it is little ſuſpected: Which may ſerve to point out the method of cure in ſuch caſes. 5. This obſervation ſeems to lead to the knowledge of the immediate cauſe of natural reſt or ſleep in a healthy ſtate; to wit, a certain quantity or proportion of freſh chyle in the blood; the want of which, from whatever cauſe, will occaſion watchfulneſs, or ſome degree thereof. And this may ſerve to point out the immediate effect and conſequences of opiats; whence may be gathered how far, and in what caſes they may be effectual and uſeful; and in what circumſtances they may be ineffectual, uſeleſs or hurtful. 6. That a due quantity of aliments at proper intervals of time, is neceſſary to keep the blood and fluids in their natural temperatue and ſweetneſs; and to preſerve them from acrimony and putrefaction: And this will be true in all diſtempers, as well as in a ſtate of health; and is againſt the practice of ſuch as pretend to ſtarve away diſtempers, or to deny a due quantity of drink and liquid food to the ſick, eſpecially in fevers, where the want of this recruit will tend to increaſe the acrimony or putrefaction, whence the malignity of moſt fevers ariſes. 7. That pus in a wound or ulcer is the product of chyle, and not of the blood or *ſerum* (which has, it is true, been the receiv'd opinion, tho' ſupported by no other proof than the ſimilitude from pus to chyle) and as a great redundancy, as well as a defect of pus, does sometimes retard the cure of a wound or ulcer, this may serve to shew by what means it may be increas'd or diminish'd, to answer the intentions of the artist. This also makes it appear probable, that a great redundancy of chyle disposeth the body to purulent, suppuratory, and scrophulous distempers; and seems to indicate the forbearing the use of such sorts of food as afford a rich, gross, or plentiful chyle, and the administering such medicines, as may strengthen sanguification, and the other assimulating powers, to assimulate and thereby consume it; the sanguification and assimulating powers being manifestly weak, as the chylification seems to be strong in all such cases. And this seems to be the reason why in adults as the sanguification grows stronger; and in age, as the voraciousness of the apetite, too common in youth, declines, these distempers do often decrease, and at last wear out of themselves: Which shews what assistances art ought to contribute to bring about the same effect in a less time.

The Dr. omitted to open the stomach and guts, in order to view the state of their contents, where the gall was entirely wanting; which might have given some light to this observation: But he is apt to think, that as most of the patient's food was liquids, the alterations would not have been very remarkable.

A Lunar Eclipse *observ'd at* Lisbon Feb. 2. 1730. *N. S. by F.* Carbone. Phil. Transf. N° 414. p. 363. *Translated from the* Latin.

True time P. M. H.	M.	S.	Phases
13	25	0	The sensible *penumbra* begins.
	40	0	It becomes denser.
	58	0	It becomes very dense.
14	3	45	The beginning of the eclipse; doubtful.
	4	32	Now it seems to begin certainly.
	6	0	Now the moon's disk appears eclips'd.
	9	47	The shadow touches the northern parts of *Terra pruinæ*.
	10	25	It comes to *Harpalus*.
	11	6	At the middle of *Harpalus*.
	16	15	It touches the north shore of *Sinus Iridum*.
	18	34	*Heraclides* entirely cover'd.
	22	38	*Plato* begins.

True

True time	P. M.		Phases
H.	M.	S.	
14	23	50	The middle of *Plato* covered.
	24	54	*Plato* entirely covered.
	29	40	The ſhadow at *Ariſtarchus.*
	31	55	At the middle of *Ariſtarchus.*
	33	42	*Ariſtarchus* entirely hid.
	34	55	*Ariſtoteles* begins to be covered.
	36	24	The middle of *Ariſtoteles* is cover'd.
	37	49	*Ariſtoteles* entirely covered.
	39	9	*Eudoxus.*
	43	57	The ſhadow touches *Endymion* and *Ariſtyllus* at the ſame time.
	44	53	The middle of *Endymion* covered and *Ariſtyllus* entirely covered.
	55	48	*Endymion* entirely covered.
	48	27	*Timocharis*; the ſhadow comes to the ſhore of *Mare ſerenitatis.*
	55	50	To *Lacus ſomniorum.*
	56	30	*Ariſtarchus* begins to emerge.
	58	20	The middle of *Ariſtarchus* emerged.
15	0	34	*Ariſtarchus* entirely emerged.
	4	25	*Poſſidonius* begins to be covered.
	11	35	*Lacus ſomniorum* entirely hid, and the half of *Poſſidonius.*
	13	12	*Timocharis* begins to emerge.
	16	5	*Timocharis* entirely emerged; and *Poſſidonius* entirely covered.
	27	54	*Archimedes* entirely emerged.
	30	49	*Poſſidonius* begins to emerge.
	32	58	*Heraclides* entirely emerged.
	34	3	*Poſſidonius.*
	40	46	*Harpalus.*
	46	21	The beginning of *Plato* emerged.
	47	16	The middle of *Plato* emerged.
	48	33	*Plato* entirely emerged.
	50	55	*Lacus Mortis.*
	52	37	*Ariſtoteles* begins to emerge.
	54	29	The middle of *Ariſtoteles* emerged.
	56	58	*Ariſtoteles* entirely emerged.
16	1	48	The beginning of *Endymion* emerged.
	3	14	*Endymion* entirely emerged.

M 2 True

True time P. M.			Phases
H.	M.	S.	
16	4	0	The end of the eclipse.

The duration of the eclipse 4^h 59′ 28″.
The middle of the eclipse 15 4 16
The quantity of 3 digits 20′ to the north.

Eclipses of Jupiter's *Satellites at* Pekin. 1727, 1728. Phil. Trans. N° 414. p. 366. *Translated from the* Latin.

Satellite I.

		D.	H.	M.	S.	
1727 Immersions	*Nov.*	2	10	21	10	in the evening.
		10	0	14	26	in the morning.
		11	6	44	10	in the evening.
		D.	H.	M.	S.	
Emersions	*Dec.*	3	2	30	42	in the morning.
		10	4	22	5	in the morning.
		11	10	50	0	in the evening.
		13	5	17	50	in the evening.
		19	0	40	44	in the morning.
		20	7	8	20	in the evening.
		26	2	32	33	in the morning.
		27	9	0	0	in the evening.
	Jan.	3	10	51	50	in the evening.
		5	5	20	0	in the evening.
		11	0	45	18	in the morning.
		12	7	13	27	in the evening.
		19	9	5	40	in the evening.
		26	10	59	0	in the evening.
		28	5	27	20	in the evening.
	Feb.	4	7	22	0	in the evening.
		11	9	16	40	in the evening.
		18	11	12	30	in the evening.
		20	5	41	50	in the evening.
	March	21	7	58	55	in the evening.
Immersions	*Sept.*	20	1	12	12	in the morning.
	Oct.	4	5	6	0	in the morning.
		13	1	50	0	in the morning.
		20	3	26	15	in the morning.
		27	5	19	30	in the morning.

Satellite II.

		D.	H.	M.	S.	
1727 Immerſ.	*Nov.*	6	4	5	40	in the morning.
	Dec.	1	3	40	45	in the morning.
Emerſions.		4	5	2	0	in the evening.
		11	7	37	42	in the evening.
		18	10	11	13	in the evening.
		26	0	47	39	in the morning.
1728	*Jan.*	5	4	42	0	in the evening.
Emerſions		12	7	16	16	in the evening.
		19	9	51	0	in the evening.
	Feb.	13	7	3	45	in the evening.
		20	9	46	0	in the evening.
Immerſion	*Oct.*	30	3	34	10	in the morning.

Satellite III.

		D.	H.	M.	S.	
1727 Begins to emerge.	*Nov.*	21	7	57	0	in the evening.
		28	11	53	0	in the evening.
1728 Total immerſ.	*Jan.*	3	5	43	40	in the evening.
Firſt emerſion			7	42	0	in the evening.
Total immerſ.		10	9	42	52	in the evening.
Firſt emerſion			11	42	20	in the evening.
Total immerſ.	*Feb.*	22	9	42	30	in the evening.
	Oct.	9	6	6	30	in the morning.

A Lunar Eclipſe *at* Pekin Aguſt 19. 1728. *N. S.* Phil. Tranſ. N° 414. p. 368. *Tranſlated from the* Latin.

Correct time. H.	M.	S.	Phaſes
			A little after the eclipſe, the moon's diameter was found to be 30′ 50″.
10	54	0	Now the *penumbra* tinged the parts of the moon that were firſt to be eclips'd.
11	2	0	The beginning of the eclipſe a little before *Cleoſtratus*.
	13	0	The ſhadow touches *Ariſtarchus*.
	14	30	*Ariſtarchus* entirely covered.
	15	20	The ſhadow touches *Plato*.
	16	50	*Plato* entirely covered.
	22	20	The ſhadow touches *Galilæus* and *Timocharis*.

Correct

Correct time			Phaſes	
H.	M.	S.		
11	23	20	The ſhadow touches *Pytheas*.	
	26	30	*Keplerus*.	
	27	30	*Ariſtyllus*.	
	31	30	*Hevelius*, *Copernicus*, and *Eudymion* almoſt at the ſame time.	
	36	20	*Ricciolus*.	
	38	15	*Poſſidonius*,	
	40	10	*Grimaldus* and *Mercurius*.	
	41	40	*Manilius*.	
	43	40	*Menelaus*.	
	47	0	*Plinius* and *Geminus*.	
	52	0	The ſhadow at the moon's center; *Grimaldus* being entirely covered.	
	54	20	The ſhadow touches *Mare Criſium*.	The ſouth apex of *Grimaldus* being at the edge of the ſhadow.
	56	40	*Ariadæus*	
	57	0	*Proclus*	
12	0	0	When the moon culminated, a ſtreight line, paſſing thro' the middle of *Tycho* between *Munoſius* and *Prophatus*, coincides at *Copernicus* with the plane of the meridian.	
	2	30	The ſhadow touches *Pro. acutum*.	*Grimaldus* emerging very ſlowly
	4	30	*Cenſorinus* and *Taruntius*.	
	6	0	*Mare Criſium* entirely covered.	
	15	30	The ſhadow touches S. *Theophilus*.	
	16	30	S. *Cyrillus*.	
	21	30	*Langrenus*; *Grimaldus* having entirely emerged.	
	25	15	The ſhadow touches S. *Catharina*; *Ricciolus* having entirely emerged.	
	31	0	About the middle of the eclipſe, its quantity meaſured with a micrometer, was almoſt ſix dig. and ½ after the *Chineſe* manner, or 7 dig. and ¾ after the *European* manner.	
	34	0	*Hevelius* entirely emerged.	
	36	0	The ſhadow at *Fracaſtorius*.	
12	43	0	*Galilæus* entirely emerged.	
	46	30	*Lansbergius*.	
	52	0	*Keplerus*.	
13	1	0	*Ariſtarchus*.	
	2	0	*Copernicus* begins to emerge.	
	5	0	*Copernicus* entirely emerged.	

The

Correct time h.	′	″	Phases
13	10	0	The edge of the ſhadow at the moon's centre.
	11	30	*Pytheas* emerged.
	15	0	*Eratoſthenes* and S. *Cyrillus.*
	20	0	*Timocharis* and S. *Theophilus.*
	22	20	*Ariadæus* entirely emerged.
	25	0	*Manilius.*
	29	30	*Ariſtyllus.*
	32	0	*Plato.*
	33	0	*Cenſorinus.*
	34	0	*Promontorium acutum.*
	38	0	*Plinius* and *Langrenus.*
14	0	0	The end of the eclipſe near *Beroſus.*
			At the end of the eclipſe the moon's diameter was found 30′ 38″.

During the eclipſe thick vapours frequently coming on diſturbed the face of the moon: So that her *maculæ* and the edge of the ſhadow could not be diſtinctly diſcerned. This chiefly happened before and about the end of the eclipſe.

Occultations of ſeveral fixt Stars, *obſerved at* Pekin *in* 1728. Phil. Tranſ. N° 414. p. 370. *Tranſlated from the* Latin.

JAN. 2. 1728 *Mane* the moon covered the ſtar *c* of *Leo.* The immerſion was at 2^h 35′ 20″ in a right line paſſing thro' *Tycho* and S. *Theophilus.* The emerſion was at 3^h 20′ 40″ in a right line paſſing thro' S. *Theophilus* and *Eratoſthenes.*

Jan. 22, early in the morning, the moon paſſed over the *Pleiades.*

	h.	′	″	
At	1	0	25	*Taygete* immerged behind the moon, in a right line with *Bullialdus* and *Abulfeda.*
	1	9	30	*Celæno*, a few ſeconds diſtant from the cuſp of the ſouthern horn, in the right line from *Tycho* thro' *Clavius*, immediately diſappear'd, being abſorbed by the exceſſive fluctuation of the lucid limb of the moon.
	1	18	24	*Sterope* immerged, in a right line with *Bullialdus* and *Fracaſtorius.*
	1	25	56	*Maia* immerged, in a right line from *Tycho* thro' *Longomontanus.*

The

The emerſion of none of them could be obſerved, by reaſon of the exceſſive fluctuation of the moon's light amidſt the vapours.

Jan. 29, in the evening, the moon covered the ſtar τ of *Leo.* The immerſion was at $9^h\ 27'\ 53''$, in a right line with *Galilæus* and *Lansbergius*; and the emerſion at $10^h\ 24'\ 17''$ in a right line with *Macrobius* and *Soſigenes.*

March 21, in the evening, the moon covered γ of *Cancer.* The immerſion was at $8^h\ 14'$ in a right line thro' *Copernicus* and the northern edge of *Langrenus.* The emerſion was not obſerved.

May 24, early in the morning at $1^h\ 51'\ 30''$ the moon abſorbed τ of *Scorpio* next to *Burgius.* The emerſion was not obſerved.

Sept. 14, in the evening, the moon covered η of *Capricorn.* The immerſion was at $8^h\ 11'\ 20''$ between *Seleucus* and *Cardanus.* The emerſion at $9^h\ 37'\ 30''$ a little below *Langrenus.*

Sept. 19. in the evening, the moon covered δ *Piſcium.* The immerſion was at $8^h\ 43'\ 45''$ in a right line thro' *Tycho* and *Langrenus.* The emerſion at $9^h\ 5'\ 15''$ in a right line with *Tycho* and *Keplerus.*

Oct. 28, in the morning, the moon covered *Regulus* or *cor Leonis.* The immerſion was at $1^h\ 39'\ 50''$ in a right line thro' *Ariſtarchus* and *Gaſſendus*, The emerſion at $2^h\ 11'$ in a right line thro' *Ariſtarchus* and *Cardanus.*

Of the Veins and Arteries of Leaves; *by Dr.* Nicholls. Phil. Tranſ. N° 414. p. 371.

BY a letter from Dr. *Fuller* in *Holland*, the *Royal Society*, was informed, that Profeſſor *Ruyſch* had in diſſecting leaves obſerved ſomething analogous to the veins and arteries in animals; but without explaining in what manner theſe different veſſels were diſpoſed, or by what means they may be didiſtinguiſhed from each other.

When Dr. *Nicholls* examined the collections of *Frederic Ruyſch* and *Albert Seba* at *Amſterdam* (in both which was a great variety of diſſected leaves) they made no mention of ſuch a diſcovery; tho' in a leaf from the collection of *Ruyſch* he could with a glaſs obſerve the fibres to be double towards the edges of the leaf; which at that time he imagined to be an unnatural diviſion of the fibres, as in decayed ſticks.

In the mean time *Albert Seba* having communicated to the *Royal Society* the method of diſſecting leaves, the Dr. ſeparated

rated

ſated the pulpous from the fibrous parts of ſeveral leaves after *Seba*'s method; when upon examining them by glaſſes, and in water, he found that each fibre was naturally ſeparated into two diſtinct fibres by a thin *ſtratum* of the pulpous ſubſtance; and that this ſeparation was continued thro' all the fibres, and ſtem of the leaf, ſo as to form two diſtinct planes of ſimilar net-work.

Tho' this duplication of the veſſels in leaves ſeems to point out an analogy between them, and the veins and arteries of animals; yet the Dr. ſees no probable means of gueſſing, which are the arterial, and which the venal fibres.

In order to illuſtrate this matter, as it appeared to him, he prepared two leaves; the one of an apple-tree (as repreſented Fig. 14. Plate IV.) the other of a cherry-tree (Fig. 15.) in which, as well the ſeparation of the fibres and ſtem, as the pulpous ſubſtance, by which they are naturally ſeparated, are very obvious.

Uncommon Anaſtomoſes of the ſpermatic Veſſels *in a* Woman; *by Dr.* Mortimer. Phil. Tranſ. N° 415. p. 373.

DR. *Mortimer*, being at *Paris* in 1723, light on a female ſubject, where the *anaſtomoſes* of the ſpermatic arteries and veins were as large as the ſpermatic veſſels themſelves: So that the arteries being injected with a groſs mixture of wax, tallow and vermillion, and the veins with the ſame, only tinged with ſmalt; the injection ran out of the artery into the vein, and on the other hand out of the vein into the artery: So that where one veſſel entered the other, the matter injected was tinged purple. It is to be noted, that the arteries were firſt injected with the red, and the veins afterwards with the blue matter.

What appeared moſt remarkable in this ſubject was, that on the right ſide were two ſpermatic arteries A and B (Fig. 16. Plate IV.) One A, aroſe from the very angle, formed by the emulgent and the trunk of the deſcending *aorta* C, which, contrary to the common courſe ran under the *Cava*; and ſoon after it was got beyond it, ſent out a lateral branch, or *Anaſtomoſis*, deſcending obliquely E F, into the ſpermatic vein G, thro' which the red matter penetrated into the vein; which afterwards, filled with blue, became of a purple colour all about the orifice of this veſſel at F, which ſeems to confirm *Euſtachius*'s delineations, and ſhew that they are no fictions. This artery A then deſcended as uſual to the right *ovarium* H.

The other right ſpermatic artery B aroſe as uſual out of the trunk of the *aorta*; but at about half an inch from its riſe, it ſent out an *anaſtomoſis* I K, aſcending obliquely into the body of the *Cava* D, thro' which a large quantity of the red matter paſt; ſo as to tinge purple a very broad place at K in the *Cava*. About an inch below this orifice was another *anaſtomoſis* L M, thro' which the blue matter penetrated out of the vein, and made the contents of the artery purple at L. The right ſpermatic vein had only this one *anaſtomoſis* M L; in all other reſpects as uſual.

On the left ſide was but one ſpermatic artery N, and one ſpermatic vein O, which incloſed, as uſual, in a common integument, made their way to the left *ovarium* P. Only the artery N took its riſe out of the body of the *aorta* near the angle, formed by it and the left emulgent artery; then aſcending between the emulgent vein and artery, turned in an arch at Q, over the left emulgent vein; and ſo joined the left ſpermatic vein as uſual, which roſe out of the left emulgent vein, as it often happens.

On this ſide there was one thing very uncommon, and not taken notice of by *Euſtachius* himſelf; namely a ſhort *anaſtomoſis* R S (about a quarter of an inch in length) from the left emulgent artery S, which forming an arch under the left emulgent vein, was inſerted into the anterior part thereof at R.

A B (Fig. 16.) repreſents two ſpermatic arteries on the right ſide; C C C, the deſcending *aorta*, and the two *iliac* arteries; D D D the aſcending *Cava*, and the two *iliac* veins; F F, L M, *anaſtomoſes* of the ſpermatic veins and arteries; G G the right ſpermatic vein, H the right *ovarium*; I K an *anaſtomoſis* of the ſpermatic artery and *Cava*; N Q N, the left ſpermatic artery; O O the left ſpermatic vein; P the left *ovarium*; R S an *anaſtomoſis* of the emulgent vein and artery; T T, V, V, V, arteries and veins diſperſed on the fat and membranes incloſing the kidneys.

A new Family of Plants, called Oxyoïdes; *by M.* Garcin *together with a Remark*; *by Mr.* Martyn. Phil. Tranſ. N° 415. p. 377.

THE *oxyoïdes* is a family of plants, whoſe flower and fruit are altogether like thoſe of the *oxys*; that is, the flower is compleat, regular, polypetalous and hermaphrodite; containing the *ovarium*, which afterwards becomes, as in *oxys*, a five corner'd fruit, divided into five cells, filled with ſmall ſeeds feeds; each of which is covered by a membrane, like a hood, which opens, when ripe; and by an elaftic motion, makes the feed leap out.

The true characters by which it is diftinguifhed from the *oxys* are, that the leaves are difpofed by pairs along a rib, without being terminated by an odd one, which makes them entirely refemble thofe of the *tamarind*. That thefe leaves are all gathered together in an umbel, on the top of a naked ftalk; that they are not in the leaft degree acid; and that they fhew as great a fenfibility, on being touched, as the fpecies of *mimofa*.

The fpecies of this *genus* are

1. *Oxyoides Javanica, fenfitiva, caule rubefcente, hirfuto flore luteo, minore*, reprefented Plate. IV. Fig. 17.

2. *Oxyoides Malabarica, fenfitiva, caule viridi, glabro altiore, flore majore*, reprefented Fig. 18.

The firft fpecies ufually grows to the height of half a foot: It is compofed of a naked ftalk, ribs of leaves, and pedicles of flowers; each of thefe parts is of equal length, and ufually three inches, when they are at their full growth; and the whole is difpofed in an umbel.

The root, which is almoft as long as the ftalk, runs ftrait down, and fometimes obliquely into the ground. It grows tapering from its neck, which is of the fame thicknefs with the ftalk: It is fet with fmall fibres, a little waved and white, and giving rife to other pretty fhort filaments. The whole root is whitifh.

The ftalk arifes fomewhat ftrait, and fometimes crooked; fometimes wrinkled, and fometimes plain throughout the whole length, pretty downy, or rather hairy, and always reddifh in fome places. It is from a line and a half to two lines thick towards the top, and ufually fomething lefs towards the bottom. This ftalk, which forms a kind of button, or little head at the top, gives rife at that place to all the other parts of the plant; that is, to the ribs of the leaves, and the pedicles of the flowers; which makes the whole tuft refemble an umbel.

The ribs of the leaves, which grow from the top of this ftalk, go on increafing till they equal the length of the ftalk. They are about the thicknefs of the treble ftring of a violin, and equal throughout the whole length: They are fomewhat downy like the ftalk.

The leaves, which grow by pairs, poffefs two thirds of the rib; that part next the ftalk being naked: The firft pair of leaves is the leaft; and the laft pair always the largeft. Thefe are commonly half an inch long; and the fmalleft are not above half the ſize of the largeſt. Theſe leaves grow ſo near the rib, that they ſeem to have no tail. Their baſe is always the broadeſt part of the whole rib, and always parallel to the rib: The reſt of the leaf bends itſelf a little forwards: The middle of their length is commonly their narroweſt part; and from thence they are gradually enlarged, and rounded at the extremities. The baſes of all the pairs are almoſt of the ſame bigneſs, except the laſt, which has the breadth on one ſide only of the little nerve, which traverſes the leaf, to avoid incommoding itſelf with its neighbour: But to make amends, the leaves of this pair are broader than the others, and a little below their extremities, eſpecially outwards. They are all traverſed lengthwiſe by a fine nerve, or thread, always bent like the leaf on the ſide of the laſt pair. They are of a lively green on the inſide, and a little whitiſh on the outſide. Their plane is garniſhed with a great many very ſlender threads, almoſt imperceptible but parallel; which likewiſe grow by pairs, and are placed at acute angles with their little common nerve, and grow ſmaller at the edge of their leaf. In ſhort, their poſition and figure come pretty near to thoſe of the *tamarind*. The number is commonly from 8 to 10 pair; and they are as ſenſible on being touch'd, as thoſe of the ſpecies of *mimoſa*. They ſhut themſelves up at ſun-ſet, as it were to ſleep, after the ſame manner as the leaves of the *tamarind*. The ribs are in number from 2 to 3 dozen; and the pedicles of the flowers are about a fourth part fewer in number; they appear of different lengths, becauſe the ſhorteſt are the youngeſt; but at laſt they uſually grow to almoſt the ſame length with the firſt. The opening of the leaves is performed almoſt after the ſame manner with that of the top of the ſpikes of the ſpecies of *heliotropium*, unrolling like the tail of a ſcorpion. The ribs and pedicles are a little hairy, as well as the ſtalk. The pedicles are of the ſame thickneſs with the ribs.

The flower, tho' it ſeem to be monopetalous, is not ſo, any more than the ſpecies of *oxys*, which ſeem to be ſo too: Otherwiſe M. *Vaillant*'s principles would be falſe, who has laid it down as a rule, that in all monopetalous flowers the chives grow from the ſides of the flowers; and that thoſe which grow from the baſe of the embryon, or rather from the *ovarium*, are always polypetalous. In ſhort, if we examine them nicely, which no one has done till now; we may obſerve, that theſe flowers have no *anus* at the baſe, but that the *petala* which are always five in number, have their baſes ſeparated very diſtinctly one from another; and tho' they are re-united about the middle

dle, which makes them look as if they were of one piece; yet they may be ſeparated without tearing.

The *petala* are equal, they are from 3 lines to 3 lines and ½ long, and towards the extremity about a third part as broad as they are long: They are ſlightly cut in like a heart at their extremities. They are of a lemon-colour, paler or deeper, according to the moiſture or heat of the ſeaſon. Each of them has a ſmall ſtreak running thro' their middle lengthwiſe. They are covered by their empalement about ⅔ of their height; and from thence they open in form of a bell. They are very tender, and laſt but the ſpace of one morning.

The empalement is one leav'd; it is two lines high, and the half of this height is the thickneſs of its baſe. It divides a little below the top into 5 lobes, very ſharp at their extremities. It is pale-green, regular and a little hairy.

The chives grow from the baſe of the embryon, being twice the number of the *petala*; five of them being higher than the other five. The higheſt reach up to about the middle of the *petala*; their ſummits are of the ſame colour with the *petala*; and the chives of the ſame colour with the empalement, or a little brighter.

The *ovarium* is very ſmall and round, but a little furrowed into five ribs, the diameter of which is about one third, or almoſt half a line. It is crowned by five teeth, which form the body of the *ſtylus*.

This *ovarium* afterwards becomes a dry fruit, of an oval form, ſtarred with 5 furrows, of which the leaſt diameter is about 1 and ½ or 2 lines. This fruit is divided into 5 cells, and opens at the top when ripe, and then expands itſelf by little and little to its very baſe; and diſcloſes ſmall round ſeeds, lodged 4 together in each cell. They are each of them covered with a little hood, or very fine membrane, which, upon the increaſe of the bulk of the ſeed, opens itſelf with violence and throws it on the ground. The colour of the ſeed pretty nearly reſembles that of *pſyllium*.

Each pedicle, during the time of its increaſe, continually puts forth new buds and new flowers, in the ſame manner as the ſtalk continually puts forth new leaves and new pedicles at the top. The number of theſe buds is commonly 5 or 6 at the top of each pedicle, enlarged into a head. Theſe buds grow, increaſe, and expand themſelves one after another; which is the cauſe that this plant, when once it begins to flower, puts forth new

new flowers every morning, which entirely vanish in the afternoon. The little bunches of buds, each of which adorns a large pedicle, are encompassed with little points, which form a kind of common empalement. The little pedicle, which is proper to each flower, is slender, and a full line long; so that its length is equal to the diameter of the empalement.

The diameter of the flower, when it is most expanded, is four lines.

The *Petala* make the empalement expand itself a little, but when the flower is faded, the lobes of the empalement draw together, and form a pyramidal body; but when the *Ovarium* grows larger, and becomes the fruit, the lobes of the empalement expand again without changing their shape; because the body of this empalement increases its diameter by the effort which the fruit makes within it.

This plant is very sensible of the least cold; it loves warm and moist places: It is found in the island of *Java*, and probably in other islands of the *Sonde*, and the *Moluccas*. When one touches its leaves they close immediately, and open again by little and little. The more they are warmed by the sun, whilst the soil is moist, the more impetuously they close against one another. The *Portuguese Indians* call it *Dormidera*, because on being touch'd it seems to sleep, by shutting up its leaves; or else because some among them think it procures sleep by being put under the ear, as M. *Garcin* has seen practised. The leaves of this species have no acidity in their taste, and communicate but a faint tincture of red to the blue paper.

Fig. 19. Pl. IV. represents the empalement of the *Oxyoides*.

Fig. 20. the flower, the petala of which are joined together.

Fig. 21. a *Petalum* apart.

We are obliged to M. *Garcin* for his curious description of this plant; whereby its *Genus* is determin'd: It is however by no means a new species; having been described long ago by *Acosta*, and other authors, under the name of *Herba viva*. Mr. *Martyn* has seen a fair specimen of it in Sir *Hans Sloane*'s *Hortus Siccus*, with which M. *Garcin*'s figure agrees very exactly. It was the first sensitive plant known in *Europe*, and very different from those which are now brought from *America*, and cultivated in our gardens under that name.

Remarks

Remarks on the Family of Plants called Musa; *by M.* Garcin. Phil. Transf. N° 415. p. 384.

ALMOST all the writers of botany have looked on this family as a tree, on account of its bigness; tho' it be tender, spongy, membranous and succulent, not at all hard or woody: Its stalk is slender and supple, not able to keep itself upright, without a great number of thick, membranous sheaths, which entirely inclose and defend it from the injuries of the weather: Besides, this plant being annual bears fruit but once; and then by degrees perishes.

Trees, on the other hand, which are ligneous, hard, and perennial, bear fruit several times. The largeness, therefore, of a plant does not seem to be a sufficient character to distinguish a real tree from a plant that is not one.

Again, the same botanists have placed the *musa* in the palmaceous class, which are all trees; probably, on account of this plant's having but one stalk, without any branches; and because the large leaves a-top divide, when they grow old, in such a manner as to resemble in some degree a sort of palm.

M. *Garcin*, having had an opportunity in the *Indies* to consider this plant better, soon found that it properly belonged to the liliaceous tribe. It is known that the liliaceous plants have several characters, which distinguish them very well: Their roots are either bulbous, tuberous, or consisting of thick, fleshy fibres: Their leaves involve the stalk more or less at their bases. The substance of their flowers is filled with silver spangles; and lastly, their fruit is always divided into three cells. The *musa* has all these characters. *Labat*, in his *travels*, affirms that the root of this plant is a thick bulb, round and massy, emitting fibres. *Marcgrave*, who has given a full description of this plant, under the name of *Pacoeira*, has observed, that at its first appearance, it sends forth 2 or 3 leaves, rolled up like a horn, which unroll themselves, and grow after the manner of the *cannacorus*: And according to M. *Garcin*'s observation, the fruit in all its species is constantly divided into three cells, which is sufficient to shew, that it is a true liliaceous plant.

As *Marcgrave*, and the Authors of the *hortus Malabaricus*, have given a large description of this plant, M. *Garcin* only gives a definition of this *genus*, to make it better known.

The *musa* is a liliaceous plant, with a monopetalous, irregular flower, incomplete and hermophrodite, composed of a tube, which

which is filled with the *ovarium*, and a pavilion divided into several lobes, and forming a kind of mouth. The *ovarium*, which strongly adheres to the tube, is triangular, and crowned with five chives, which grow from the sides of the flower; it has also a *stylus*, which is terminated by a little head. It afterwards becomes a soft, angular, long, crooked fruit, something like a cucumber. This fruit, when ripe, is fleshy, and divided into three cells, filled with a mucilaginous pulp; under which the seed is placed along a *placenta*, which serves as an axis to the fruit.

This seed is small, round, and edged with an almost imperceptible leaf. The flowers grow at the end of the stalk, in knots disposed in a spike. Each knot is loaded with two rows of flowers, covered with a membranous, hollow, thick, oval, covering, which serves them for a common empalement. In the *hortus Malabaricus* there are three plates, which exhibit a good representation of the plant, its flower, and fruit; but M. *Garcin* observed three defects in them: 1. The flower is not represented in its most perfect state, but almost withered; and so its pavilion is too much cleft, which makes the flower seem tetrapetalous: For, the flowers of these plants divide when they are old, as well as the leaves. 2. The three cells are not shewn distinctly, in the transverse section of the fruit. 3. That the seed is not represented at all.

This family comprehends about 25 species, known to the *Indians*; the differences of which are usually taken from their fruit. This plant does not perish before it has ripened its fruit; whence it might last longer in a temperate climate, cool enough to retard its fruit.

The rind of the fruit is formed of the tube of the flower; and the lobes dry away during the growth of the fruit.

Fig. 22. Plate IV. represents the fruit of the *musa*, half stripped of its bark.

Fig. 23. The fruit cut thro' the middle.

Fig. 24. The fruit cut transversely, distinguishing the three cells and the seeds.

Fig. 25. Shews another species of *musa*, cut transversely, represented in the *hortus Malabaricus*; but having the cells better distinguished here: The six black points represent the seed.

The

The year Letters.		The hour Letters.	
1 甲	Kia.	1 子	Tse.
2 乙	y.	2 丑	Tcheou.
3 丙	Ping.	3 寅	Yn.
4 丁	Ting.	4 卯	mao.
5 戊	Uou.	5 辰	Chin.
6 己	Ki.	6 巳	Se.
7 庚	Keng.	7 午	ou.
8 辛	Sin.	8 未	Wei.
9 壬	Gin.	9 申	Chin.
10 癸	Kuei.	10 酉	Yeou.
		11 戌	Sio.
		12 亥	hai.

Fig. III.

1 甲 Kia. 子 Tse.

2 乙 y. 卯 mao.

3 始 Chi. 皇 hoang. 帝 Ti.

4 庚 Keng. 辰 Chin.

5 黄 hoang 帝 Ti.

6 甲 Kia.

7 乙 y.

8 閼 o. 逢 Fong.

9 旃 Tchcou 蒙 Mong.

10 丙 Ping

11 柔 Leou. 兆 Tchao.

12 子 Tse. 午 ou.

14 困 Kouen 敦 Tun.

15 敦 Tun. 牂 Tsang.

16 羊 yang.

17 丬 Tsang

18 午 ou.

19 丙 Ping. 辰 Chin.

20 丁 Ting. 亥 hai.

21 酉 You. 子 Tse.

22 甲 Kia. 申 Chin.

23 元 Yuen

24 癸 quei. 酉 Yeou.

25 玄 hiuen.

26 天 Cœli. 子 filius.

27 聖 Ching. 祖 Tsou. 仁 gin. 皇 hoang. 帝 Ti.

28 胤 Yn. 禛 Tchin.

29 雍 Yong. 正 Tching.

* 自 Tse. ase. 王 Wang. Regnans

生物之初其本原皆從子子由黄帝之所以始也

Fig. II.

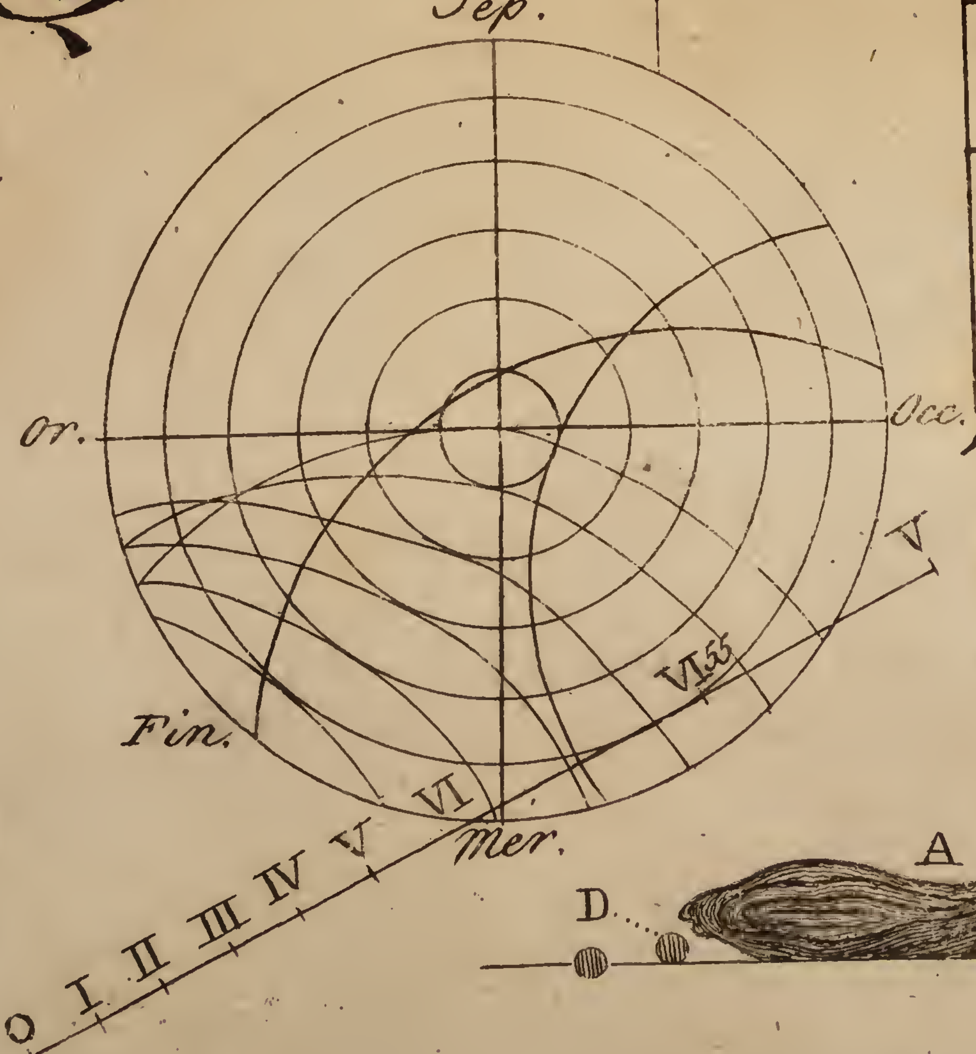
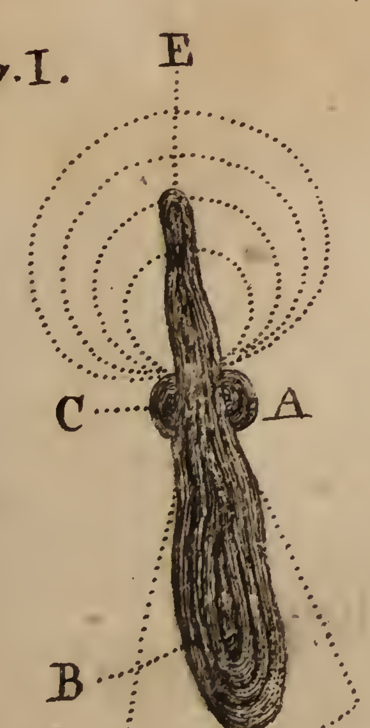


Fig. I.



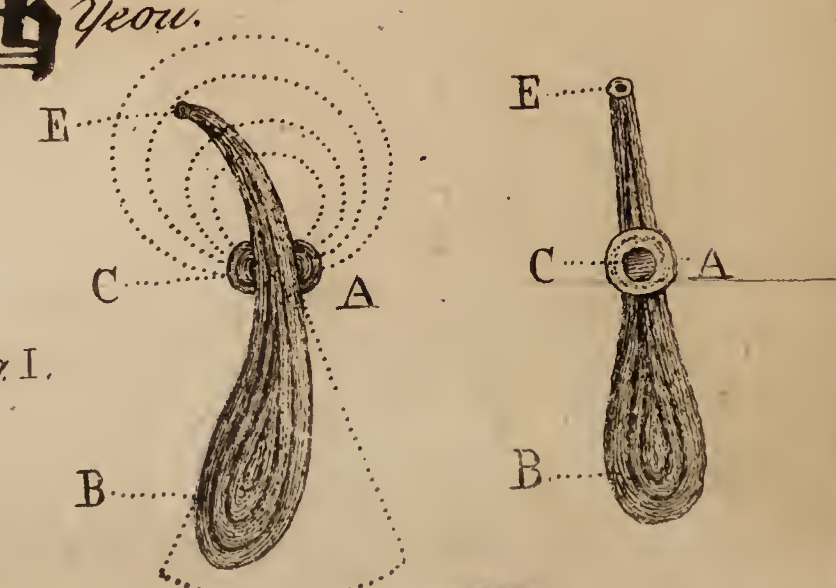
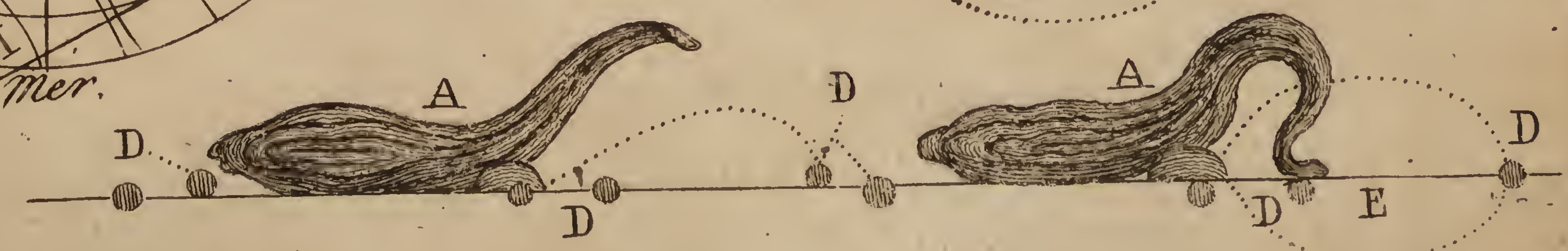


Fig. I.



The Hirudinella Marina, *or* Sea-leech; *by M.* Garcin. Phil. Transf. N° 415. p. 387.

M. *Garcin* found this worm in the empty ſtomach of a fiſh, which the *Portugueſe* call *Bonite*: It was faſtened by its protuberance upon one of the folds of the inner membrane. It made a pretty deal of reſiſtance when he endeavoured to pluck it away,

Its ſhape came very near that of a leech; it had all the motions of that animal, together with ſome peculiar to itſelf.

Fig. 1. Plate V. repreſents this inſect as big as the life, and according to its moſt uſual dimenſions; its body is round almoſt throughout its whole length, but ſomewhat flatted towards its belly B: So that its circumference, taken according to its thickneſs, is almoſt elliptic: It is adorn'd all along with little circular furrows, parallel to each other, and very cloſe together, but ſo fine, that one can ſcarce perceive them without a microſcope. It is of a greyiſh colour, and its body a little tranſparent. On its back, as well as underneath, two black lines begin by an acute angle towards the neck, and running thro' the whole length of the body, ſeem to terminate towards the *anus*. Theſe lines are tubes or *viſcera*, which ſerve for nutrition, or chylification, and appear thro' the integuments. M. *Garcin* divides the length of this little leech into two parts, diſtinguiſh'd by the centre of the little protuberance C, which is under its belly; and is a muſcular body, in form of a ſpherical bladder. Theſe two parts of the body are in the ratio of four to three. He calls them the fore and hinder part. This little protuberance, in its greateſt extenſion, may be compared to the cup of an acorn, with the mouth a little contracted.. The head E, which is the ſmalleſt end of this worm, has a hollow body underneath of a conical, or almoſt hemiſpherical figure; which ſeems to ſerve it for a mouth to ſuck, as well as to faſten itſelf on the various bodies, which come in its way, after the manner of other leeches.

The belly B is of a dark colour; becauſe ſeveral *viſcera*, contain'd therein, are filled with a thick, black liquor; which makes it look as if the ſkin were of that colour. The forepart C E is variouſly ſhaped, according to its different motions; ſometimes it lengthens itſelf, and then it becomes ſlender; the diminution being made by degrees up to the head;

and ſometimes it contracts itſelf; and then the thickneſs increaſing, it becomes all of an equal bigneſs. The hinder part C B does not change its figure, becauſe it moves but ſlowly, and very ſeldom. When this inſect ſtops itſelf any where, it holds ſtrongly by means of the protuberance. Before it apply the protuberance, it ſhortens it, by withdrawing the edges, or the circumference towards its centre; and after it has applied the orifice of its protuberance upon the ſurface of any body, it lifts up a little the centre or bottom towards its own body; afterwards it ſwells and ſtretches it on all ſides, according to all its dimenſions. This protuberance, thus applied, ſtretch'd, and void of air, makes that which endeavours to enter, preſs it externally on all ſides, and hold it ſo faſt, that it is above the ſtrength of the animal to ſeparate it from the place where it is applied. This animal being thus faſtened, and detain'd by its protuberance, its fore-part is always in motion, whilſt its hinder part remains almoſt immoveable. It ſtretches its head ſometimes to the right hand, ſometimes to the left, by lengthening and ſhortening its fore-part, which bends and ſtreightens itſelf very frequently. The extent of all theſe motions are mark'd in the figure by pricked circles of different magnitudes; all which touch one another at one point of their circumference, at the centre of the protuberance, which is the beginning and fix'd point, as it were, of all theſe motions. When this little animal deſires to change its place, it makes uſe of its protuberance and its ſucker, which is the little hollow under its head, and ſeems to ſerve it inſtead of a mouth: It applies this part to the place D, whither it would remove its body; and after being prolonged by its fore-part to reach the place, where this application ſhould be made, it draws its protuberance and ſucker together, by bending its fore-part circularly, after the manner of ſome caterpillars. Its protuberance being applied, it looſens its ſucker, and prolonging itſelf, applies it to another place more forward: The ſucker being faſtened, it bends itſelf circularly again, in order to bring the protuberance up to it, and apply it as before. By this we ſee that the worm prolongs itſelf to apply its ſucker, and contracts itſelf to do the ſame with its protuberance. Thus theſe motions and applications are made ſucceſſively, and as often as there is occaſion. The hinder part faſtens itſelf to nothing, but is always drawn by the part which goes before it.

This

This little animal did not live above two hours after it was taken out of the place M. *Garcin* found it in: It grew languid as ſoon as it was expos'd to the air, and recovered ſome vivacity as ſoon as it was put into a little ſea-water; and as ſoon as it was put in the water, it ſent out from its mouth a ſmall green, almoſt imperceptible, thread, which kept itſelf ſuſpended in the water, and was about as long as its body, and as fine as the fineſt thread of a cob-web. After this thread was put forth, it likewiſe emitted from the ſaid place ſome little bubbles of air. The body of the worm, while alive, decreas'd in bulk by little and little; and after its death this diminution either ceas'd or became leſs ſenſible. Having, as ſoon as it was dead, cut its belly thro' with a pair of ſciſſars, and ſqueez'd it, there iſſu'd a black, thick, liquor.

From theſe facts we can draw but very ſlender conſequences. It is certain that this inſect cannot live out of the water: So that one cannot imagine it could live in the ſtomach of any land animals, unleſs they came near the nature of the amphibious: For, the worms which grow upon, or within the bodies of animals, ought to be of the ſame nature with them, with regard to the elements in which they live. This worm ſeems to be incapable of living any where but in the bodies of fiſh, ſeeing it kept alive but a very little time in the ſea-water, in which it was put, having been expos'd to the air but one moment at two different times, which was not ſufficient to alter its parts, and cauſe its ſudden death. The almoſt immediate diminution of its bulk in the water is another mark that it cannot live in the ſea out of the body of the ſame fiſh: For, if the water, which was more natural to it than the air, were injurious to it, much more would the air, to which M. *Garcin* expos'd it. The fine fibre which it put forth, and the decreaſe of its bigneſs, were ſigns that it ſuffer'd ſome uneaſineſs. The black and thickiſh juice, which iſſu'd out of its intrails, could be nothing but ſome half coagulated blood, which it had ſuck'd in the ſtomach of the fiſh.

As the *bonite* is a fiſh of prey, living on other ſmall fiſh; it is probable that this little leech uſually faſtens itſelf on thoſe which come into the ſtomach, and that it lives on their blood.

The ſtomach in which M. *Garcin* found it, was quite empty: So that it was, probably, as hungry as the *bonite* could be: For, this fiſh is not eaſy to be catch'd, but when hungry. However, it was the firſt time he found it ſo very empty, tho' he had ſeen a great number opened.

A Solar Eclipſe obſerv'd at Wirtemberg, *July* 4. 1730. *O. S. by M.* Weidler. Phil. Tranſ. N° 415. p. 394. *Tranſlated from the* Latin.

True time before noon			Phaſes		Obſervations
H.	′	″	Dig.	min.	
3	56	0			The ſun riſes behind clouds.
	59	0	5		The ſun hid behind clouds.
4	10	30	6	55	
	26	0	6	30	1. The ſun riſing (as repreſented in
	33	0	6	0	Fig. 2. Plate V.) exhibits an elliptic
	38	0	5	30	figure: The vertical diameter appears
	43	30	5	0	two dig. or $\frac{1}{6}$ part of the ſaid diameter
	47	0	4	30	ſhorter than the horizontal one.
	50	15	4	0	2. That part of the moon, that regarded
	53	33	3	30	the weſt, had a very remarkable aſperity
	57	0	3	0	on its edge: For, at $4^h\ 3'$ a valley was
5	3	30	2	0	diſtinctly obſerv'd, $\frac{1}{10}$ part of the moon's
	7	0	1	30	diameter in depth, and about $\frac{1}{21}$ part of
	10	30	1	0	the ſaid diameter in length. In the pro-
	13	0	0	30	greſs of the eclipſe the unevenneſs of the
					moon's limb was diminiſh'd, and hid by a
					blueiſh *faſcia*, adhering to it; and this
					faſcia gradually dilated itſelf as the ſun
					roſe higher; beſides this blue colour,
					there appear'd a reddiſh colour cloſer to
					the moon; and about the end of the eclipſe
					the thickneſs of the coloured *faſcia* ap-
					pear'd to be $\frac{1}{36}$ part of the moon's diame-
					ter nearly.
					3. Beſides, a continual commotion of
					the ſun's light was obſerv'd near the
					colour'd edge of the moon's diſk.
	15	30	0	0	The end of the eclipſe.

The

The same Eclipse observ'd at Padua; *by M.* Polenus. Phil. Transf. N° 415. p. 396. *Translated from the* Latin.

AS the sun was rising, thin clouds almost surrounded the horizon; but these afterwards dispersing, the air was somewhat foggy; so that the solar *maculæ* could not appear distinctly.

July 15. 1730. N. S.

Dig. eclipsed	True time H.	′	″
4	16	46	12
3 ½	16	48	7
3	16	50	36
2	16	57	24
1	17	1	20
½	17	3	29
The end	17	6	8

An Explanation of the new Chronological Table of the Chinese *History; by F.* Foucquet. Phil. Transf. N° 415. p. 397.

THE *Chinese* original table (one of which, printed at *Canton*, was presented to the *Royal Society* by Sir *Thomas Dereham*, and is now reposited in their library) from which F. *Foucquet*'s translation was made, is owing to the learned *Nien hi yao*, a *Tartar* illustrious by birth and merit, and Viceroy of *Canton* in 1724: For the *Tartars*, since their conquest of *China*, are become well vers'd in sciences, and especially in the history of the empire they conquered. Yet this gentleman is not the author of the chronological system he has here drawn up: He himself tells us, he has taken it from the most valu'd historical work in *China*. What renders this writer praise-worthy, is his ranging his system in a beautiful order, which makes it exceeding easy to see at first sight the series of the dynasties, or imperial houses, the names and succession of the emperors, the beginning, end and duration of each of their reigns: However, this is not the only advantage of this new table: The ancient chronology of *China* is therein reduced to its true beginnings. The most remote *epocha* of this chronology, according to this author, does not surpass

ſurpaſs the firſt year of a prince, call'd *Guei lie wang*, who began his reign 424 years before the vulgar *æra*. Some there are who think this *epocha* might ſtill be brought nearer to us; not to fix there the origin of the nation, which, for ſtrong reaſons, may be traced back to near the deluge; but becauſe from much later date only, doth any certainty appear of whatever is pretended to have befallen this famous people. *Se ma quang*, (*Sema wen*, or *Sema wen Kong*) and *Tchu hi* the two graveſt hiſtorians *China* has produced, were of this opinion: The firſt flouriſh'd in the year of Chriſt 1061, in the eleventh or twelfth century; the ſecond about the end of the twelfth or beginning of the thirteenth century. They have both omitted whatever is before the time of *Guei lie wang*, nor would they mention ought of it in their hiſtories. Nay, they have not begun them till the 23 year of *Guei lie wang*, ſomewhat later than *Nien hi yao*, who begins with the firſt year of this prince's reign. It is on the example and authority of theſe two illuſtrious philoſophers that *Nien hi yao* has relied in ſuppreſſing what preceeds: By fixing this *epocha* at *Guei lie wang*, fabulous times and a thouſand errors and abſurdities, current in *Europe* concerning three imperial (abſolutely imaginary) families, and reigns anterior to, but no leſs chemerical than theſe families, are retrench'd. Theſe errors will ſoon vaniſh of their own accord: So that the ſubject of ſo much laborious, but uſeleſs lucubration and ſtudy, will at length ceaſe; a worthy motive for congratulating the learned world.

This is not all: We are ſtill particularly obliged to the ingenious *Tartar* for having found means to place in his table the cycle of 60 years, call'd *Kia Tſe*, ſo much eſteem'd by the *Chineſe*, that it is as the foundation of their whole chronology; a point which requires explanation. As we mark the incidents of ancient hiſtory by the years of the olympiads, ſo the *Chineſe* mark what has happened in their country by the years of this revolution. According to the *Chineſe*, the prince under whom the great wall was finiſh'd, began his reign the 52d year of a cycle, which is found to be the fourth in this chronological table, reckoning from the cycle of the general *epocha* incluſive: This general *epocha* is the firſt year of *Guei lie wang*. Every year of the *Chineſe* cycle is mark'd by two letters, which make up its proper character, and diſtinguiſh it from the other 59 repreſented in Plate V.

Thus

Thus the firſt year is call'd (1) *Kia Tſe*, and gives its name to the whole cycle. Thus the 52d year of the fourth cycle, in which the prince, who finiſh'd the great wall began his reign, is call'd (2) *Y mao.* This prince, after bloody wars, became Monarch of *China*, and then abandoning himſelf to ſuch impious pride, as the philoſophers reproach'd him with, caus'd himſelf to be call'd (3) *Chi hoang Ti*, that is, *the firſt maſter, the firſt Emperor reigning of himſelf:* For, this is the real ſignification of theſe characters; and thoſe glorious titles belong to God alone in the ancient monuments. This unheard of uſurpation happened in the 26th year of his reign, which is the 17th of the fifth cycle, and is there called (4) *Keng Chin.* It is thus that all the years of the emperors for above 2000 years, have names in hiſtory common to them, with the correſponding years of the cycle; and theſe names common to both, are a ſort of link, which unites the years of the emperors to the cycle, and thereby prevents confuſion: Hence we ſee how the cycle among the *Chineſe* is the baſis of all their chronology.

Here a queſtion naturally ariſes, concerning the ſignification of theſe characteriſtics, which diſtinguiſh the years of the cycle and emperors: It is to be wiſh'd it were as eaſy to anſwer this queſtion as it is natural to propoſe it: But it regards characters ſo widely different from ours, that their nature or origin have never been well extricated, nor has there been any principle hitherto eſtabliſh'd for their explanation. We muſt remark.

1. That it is not poſſible to tranſlate theſe names. 2. That they are compos'd of two ſorts of characters (as repreſented in Plate V.) very famous among the *Chineſe*, who in their youth get them by heart, and employ them on a thouſand occaſions. Theſe of the firſt ſort are ten in number, and are call'd *year-letters*; theſe of the ſecond ſort are twelve in number, and are call'd *hour letters.* 3. That theſe two ſorts of characters are combined, by repeating the ten year-letters ſix times, and the twelve hour letters but five times; and from this combination reſult 60 names for the years that compoſe the cycle: Theſe three points well comprehended, ſuffice for the uſe and underſtanding of the chronological table.

The *Chineſe* pretend that theſe 22 letters were invented by a very ancient king, they call (5) *Hoang Ti*, in order to determine the beginning, progreſs, end, and ſucceſſive periods of a great year: For, they have one which includes a certain number of ages, tho' its total duration be no where diſtinctly markt.

They

They ſay the great year is ſucceſſively at *Kia*, at *y* and a *Ping*. Now it is no eaſy matter to determine the extent of theſe different parts of the great period (for there is room to conjecture that they are unequal) how long, for inſtance, laſts that which commences at (6) *Kia*, that at (7) *y*, and ſo of the reſt; nay, it is perhaps impoſſible, for want of certain principles the knowledge of which is entirely loſt. When the year was at *Kia*, which ſeems to ſignify when it began, this point of time according to tradition, is call'd (8) *O Fong*; when it was at *Y* this is call'd (9) *Tcheou mong*; when at (10) *Ping*, the name given it was (11) *Jeou Tchao*. Every one of the other 19 letters has in this manner a word for its device: But as it is plain that all theſe words are very uncouth to *European* ears, and that thoſe which remain are as obſcure and barbarous as *Kia Tſe Y mao*, *Keng chin*, M. *Foucquet* omits mentioning them. Nevertheleſs, one ſhould not eaſily believe that theſe words are void of all meaning; or that the letters, whoſe names they are are figures made at hazard, or arbitrarily imagined: The inventor of theſe names muſt have propos'd to himſelf ſome end. It is already known in general, and is demonſtrated elſewhere, that the characters preſerv'd by the *Chineſe*, but much more ancient than them, are true hieroglyphics: It is likewiſe known and ſtrongly demonſtrated, that the doctrine veil'd under the appearance of theſe hieroglyphics, is very myſterious and ſublime: And it is unreaſonable to regard as nonſenſe, and reject ſuch as we underſtand not, purely becauſe we do not underſtand them. And indeed when we narrowly examine the 22 letters in queſtion, we perceive in ſeveral of them ſomewhat very myſterious, with which the *Chineſe* themſelves preſent us, without underſtanding them; for inſtance, (12) *Tſe*, the firſt of the hour-letters, ſignifies with the *Chineſe* both the moment of midnight, and a tender babe juſt born, wrapt up in his ſwadling-cloaths. *Ou*, the 7th of the *hour-letters*, ſignifies the moment of noon, and a man lifted on a croſs. This letter ſignifies noon, according to the primitive meaning, which ſtill ſubſiſts, without having ever been diſus'd; it alſo ſignifies a man lifted on a croſs; as is evident to the eye by the character itſelf. Some difficulty may be raiſed on this point, but it ſhall be reſolved anon. Where have this people got ſuch ideas? They are unintelligible to them at preſent; and yet (it is ſtrange) they preſerve them preciouſly, and uſe their utmoſt endeavours to find out the ſenſe of them, but to no purpoſe. It will increaſe the

ſurpriſe

ſurpriſe to reflect on a *Chineſe* axiom, the ſenſe of which is that the heavens opened at the hour of *Tſe*, which, according to the foregoing expoſition, ought to be underſtood of the moment of midnight. And in order to raiſe the admiration a degree higher, *Tſe*, which ſignifies an infant, is literally and properly uſed to ſignify ſon. Now let the reader attend to the ſurpriſing words of a *Chineſe* writer on this ſon. '(13) the firſt 'inſtant, *ſays he*, of the production of things, their principle 'and origin came from the ſon. The ſon is the cauſe by which 'all things had a beginning.' When the year is at (12) *Tſe*, that is called (14) *Kouen Tun*; this *Kouen* in the common acceptation, ſignifies work, pain, grief; *Tun* ſignifies being reduced to great anguiſh: The application of theſe words to the tender babe, to the ſon lately born, produces a meaning, which by being too intelligible and too beautiful, raiſes wonder. When the year is at *Ou*, it is called (15) *Tun Tſang*. We have ſeen that *Tun* ſignifies anguiſh, affliction: In order to have the true ſignification of *Tſang*, recourſe muſt be had to the analyſis, as on infinite other occaſions: The analyſis gives (16) *Yang*, the emblem of a lamb, and (17) *Tſang*, which ſignifies to divide, to pierce. Thus at the hour of noon, marked by (18) *Ou*, that is, a man on a croſs, the lamb was pierced. This ſo uſeful a cycle, which in the printed hiſtory is a certain rule to fix time, the ingenious *Tartar* has diſpoſed in his table with ſuch art, as renders the relation of the years of the cycle to the years of the emperors very ſenſible: Whence ariſe great advantages, that are very viſible to whoever attentively conſiders the table, and penetrates into its arrangement. In the front of the table appears a line writ in capital letters, which extends horizontally from right to left: This line contains, according to the order of their ſucceſſion, the names of 21 dynaſties, or imperial families, who have reigned four centuries before *Jeſus Chriſt* till this time. Theſe names placed exactly on the lines, where are the beginnings of the dynaſties to which they belong, are as ſure guides for eaſily finding them; and under the direction whereof one comes without difficulty to the knowledge of the emperors of theſe imperial families, as well as the incidents of their reigns. This cycle is placed in the middle, in a perpendicular line or column, which extends from the top to the bottom of the table, and is divided into 60 little lodges or ſquare *area*'s, every one of which anſwers to a year of the cycle, and contains the name of the year it anſwers to. The angles, or empty ſpaces, which ſurround the name in each of theſe lodges, were coloured black, that the whole may the more readily strike the reader's eye, and be the more easily distinguished. On the right and left of the cycle thus placed are ranged 20 other columns, divided into 60 lodges each, in the same manner as the cycle; and consequently, equal to the cycle to which they are parallel. It is in the lodges of these columns, parallel to the cycle, that the years of the emperors are disposed in their natural order for above 2000 years. They are disposed from top to bottom, from the right to the left, after the *Chinese* custom, that is, from the right to the left of the person that reads the table. And it is essential to remark, that the arrangement is such, that each of these imperial years, referred to the column of the cycle by a horizontal line, which falls at right angles on this column, answers to the year of the same cycle, whose name it bears in history: The columns at the end are left blank to put down the future emperors, as they shall succeed.

Pursant to this explanation, the first year of the Prince, called *Guei lie wang*, at which the table begins, whereof that is the *epocha*, will be found in the first column at the right hand, pretty near the bottom, under the author's small preface; and opposite to the 53d year of the cycle, called (19) *Pin chin*; because in history this first year of *Guei lie wang* has the two letters *Ping chin* for its characteristic. The reason why this first gear of *Guei lie wang* is taken for the general *epocha* of the whole table, is, because there is neither clearness or certainty in the history before it: But if, because this first year of *Guei lie wang*, is taken for an *epocha*, it were placed opposite to the first year of the cycle, it would occasion an anachronism of 53 years; a capital point, to which such as intend to use this chronological table, cannot give too much attention. In a word, since history has given this first year of *Guei lie wang* the name of *Ping chin*, it is not allow'd to give it any other in the table; and one is obliged to refer it therein to the year of the cycle that bears that name, to avoid confounding time, and puzzling chronology. It is in this arrangement that all the artifice of this new table consists: And this point, once well understood, is a key which gives entrance into all the rest.

The characteristic names of the 60 years, which compose the cycle, do by their connection with the years of the emperors determine the precise time of incidents: Hence arises clearness and certainty in the *Chinese* chronology: For, these characteristicks contribute to the discovery of errors, which either the

ignorance

ignorance and neglect of copyists and printers, or the want of attention in authors, often introduce into chronology. For instance, in the chronological table of the *Chinese* monarchy, printed at the end of the work, entitul'd *Confucius Sinarum philosophus*, it is said, that *Chi hoang Ti* (vide *Monarch. Sin. tabul. chronol.* p. 24, 25.) in the 24th year of his reign, built, or (to speak more accurately) finished the great wall; and consequently, the burning of the books is placed in the same emperor's 25th year. Now according to history, the great wall was finished in the year of the cycle, called (20) *Ting hai*, a name that can agree only with the 33d year of this emperor's reign. —As to the burning of the books, it is marked in history in the year (21) *Vou Tse*, which necessarily answers the 34th year of this wicked prince.

Thus these characteristic names of the years, that compose the cycle, are as a touch-stone, that is of wonderful service for distinguishing truth from falshood, and re-establishing order, when disturbed. This cycle removed, the years of the emperors might be very easily confounded, by augmenting or diminishing their number. When an emperor is newly come to the throne, if the first year of his reign be reckoned that, wherein his predecessor died, it is placing two years in one; because according to the *Chinese* custom, the year wherein an emperor ends his reign, is entirely attributed to him, tho' he died in the beginning of the first month; and his successor is reckoned to reign only from the beginning of the ensuing year. Yet this custom, tho' very common, is not so universal, but that some emperors have deviated from it. The *Tartarian* emperor *Tchang Hoang Ti*, founder of the dynasty now reigning, caused the year, wherein *Hoai Tsong* had murdered himself, to be taken for the first year of his reign, which was the seventeenth and last of this last emperor of the *Mings*. If, according to custom, this seventeenth and last year of *Hoai Tsong* were distinguished from the first of *Tchang hoang Ti*, it would be making two years of one, which would confound time. Resume the cycle, apply it to the years of the emperors, and these errors will appear of themselves. You will see that the year in which *Hoai Tsong* died was called (22) *Kia chin*; that that in which *Tchang Hoang Ti* began his reign, was likewise called *Kia Chin*; therefore they are the same year: If it were made two, the mistake would be discovered at first sight, and should be corrected.

Under (23) *Yven* those accidental *Tartars*, whose domination over *China* began in the year 1280, and ended in 1368, the emperor *Wen Tsong* died in 1333: *Ning Tsong* his successor reigned but some few months; and *Chun Ti*, who succeeded *Ning Tsong*, mounted the throne towards the end of the same year. Three years may be easily made of this one, in order to place the three princes just named. But whoever makes use of the cycle need not fear the mistake. The death of the two first emperors, and the accession of the third to the throne, are three incidents, which history refers to the year of the cycle, called (24) *Quei yeou*; and this characteristic name is a link, as it were, that binds them all together: So that it is no longer possible to separate them.

Another property of this new table, no less remarkable or useful than the foregoing, is, that it lays before the eye all the names of the particular *epocha*'s, assumed by the emperors of *China* for near 2000 years: For, *Han uou Ti*, the first who took this sort of *epocha*, began his reign 140 years before *Jesus Christ*.

No body, so far as M. *Foucquet* knows, has given *Europe* a sufficient account of the nature of these *epocha*'s; tho' they be very well worth explaining.

The emperors of *China* have a particular custom, little known in *Europe*, which, if care be not taken, would infallibly spread darkness and confusion over chronology and history. It is not allowed to pronounce the proper name of any emperor during his life, which is looked on in some measure as ineffable. This respect continues even after their deaths: For, then it is not by their proper names they are mentioned, but they are consecrated (so to speak) by a surname, which is a sort of character of canonization. And under this title are they received into the burying place of their ancestors, and afterwards ranked in history. But in their life time, to supply the name that dare not be pronounced, they themselves, in imitation of *Han uou Ti*, already mentioned, choose and determine a term that serves for an *epocha* to the incidents of their reign. This term we call *epocha*; because it is from it the years of emperors are reckoned, and to it every thing is referred that falls out during these years. Examples will make these things easy to comprehend. The famous emperor who died *Dec.* 20. 1722, after a reign of 61 years, had the letter (25) *Hiuen* for his proper name. During his reign, this letter was not to be put into any public memorial, book, or writing. The letter (25) *Yuen* was

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ſubſtituted in its room, becauſe it would be a kind of prophanation to employ for common uſe the name of a prince, who ſtiled himſelf (25) *ſon of heaven.* After his death his 4th ſon, who ſucceeded him, gave him for title of canonization, the glorious ſurname of (27) *Ching Tſou gin hoang Ti*, that is, *the holy Anceſtor, the auguſt, good and merciful Emperor.* This character *Gin*, which M. *Foucquet* has tranſlated *gracious and merciful*, ſignifies *charity.* It alſo ſometimes expreſſes *the conjunction of all virtues:* And it may bear that ſenſe here. The character (27) *Hoang*, when analyſed, is found to be compoſed of *Tſe*, which ſignifies of himſelf, and *Wang*, which tranſlated is *reigning.* It is under this ſurname that the ſaid emperor has been interred among his anceſtors; and it is under the ſame that hiſtory will make mention of him for the future. Upon his aſcending the throne, after a father who had conquered *China*, he aſſumed for the *epocha* of his years the two letters *Kang hi*, the meaning of which is *ſolid peace*, or *laſting and glorious tranquility.* Thus becauſe in the 38th (35th) year of his reign he conquered by his generals a prince of *Tartars*, named *Kaldan*, this victory is ſaid to be gained the 38th year of *Kang hi*, or of *the laſting and glorious tranquility.*

The letters (28) *Yn Tchin* compoſe the name of his 4th ſon, who now reigns: Wherefore the uſe of theſe letters is and will be prohibited till a new government. As to the title of canonization, by which this prince is to be recorded in hiſtory, it will not be given him till after his death. But upon his acceſſion to the crown, as he had a great number of brothers and nephews, he took for *epocha* of his reign the two letters (29) *Yong Tching*, which ſignify *direct concord*; to give to underſtand, that if his brothers and nephews pay him the reſpect and ſubmiſſion they owe him, he would treat them kindly. The empreſs his mother died ſome few months after he began his reign: So the death of this princeſs will be marked in hiſtory in the firſt year of *Yong Tching*, or of *the direct concord.* Thus will all other incidents be fixed by the years of the *direct concord* in which they ſhall happen.

It is plain from theſe examples, that the names of emperors, and of their *epocha*'s, are eſſentially different; and that thoſe of the *epocha*'s contain very inſtructive meanings, the underſtanding which muſt be of conſiderable ſervice, as to the clearing up of hiſtory. But there is great danger leſt the name of an *epocha* be made the name of an emperor; which would double the number

number of emperors, ſuppoſing even that each of them had taken but one *epocha* during his reign. No *European* writer, M. *Foucquet* knows of, has faithfully given them all: But this table preſents us with an exact and entire ſeries of them.

And ſtill it is a thing much to be wiſhed for, to have a faithful explanation of them; a work which would engage one in a review of the whole hiſtory; but will be undertaken nevertheleſs, if M. *Foucquet* find it will not be diſagreeable to the learned. The inconveniency is that a great number of emperors have often changed theſe names of *epocha*'s; but this inconveniency is not found in the dynaſty now reigning; tho' in the more ancient it be a very common diſorder. *Han uou Ti*, who firſt introduced the uſe of *epocha*'s, aſſumed, during his 54 years reign, to the number of 11 very different *epocha*'s. Several others have followed his example, which cannot but cauſe a great deal of confuſion in hiſtory; if one happened to imagine, as it is natural enough to do, that theſe names of *epocha*'s are the names of ſo many emperors. It was of importance to clear up theſe things thoroughly; this the table does: And to avoid miſtake, care has been taken to have the emperors names or titles engraved in large characters, and thoſe of the *epocha*'s in ſmall letters. Moreover, where an emperor, not content with one *epocha*, has taken ſeveral, notice is given thereof by an aſteriſm, placed on one ſide of the firſt.

In ſhort, to leave nothing conjectural, as often as the reader, conſidering this table, ſhall find two ſeparate ranks of figures, oppoſite to one another, in a ſeries of ſeveral lodges, or *areola*'s, denoting different numbers, he is to remember, that theſe figures mark the years of emperors of two families, which diſpute the empire; one of which being ſoon to periſh will give room to the other to aſcend the throne. The column found under the title *San Koue*, that is to ſay, *the three Kingdoms*, is an inſtance hereof. This title of three kingdoms denotes the time when *China* was divided into three different parts; and the column, on the top of which is found that title, in the order of the dynaſties, is the twelfth, reckoning from the firſt at the reader's right hand incluſive. We ſee in the 43d lodge, that the firſt year of the *epocha Tai ho*, aſſumed by the emperor *Ming Ti*, of the family, called *Guei*, anſwers to the fifth year of the *epocha Kien hing*, aſſumed by *Heou Tchou*, emperor of the *Han*'s. The ſecond year of the *epocha Tai ho* anſwers to the ſixth of the *epocha Kien hing*; and ſo of the reſt that follow.

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The reason is that the empire was at that time torn in pieces by bloody wars: The *Guei*'s were getting the upper hand, and the *Han*'s were very near their ruin.

As to a great many lodges that have but one or two figures, without any account of history, they are unpleasing blanks; which however the *Chinese* matter not, satisfied to have an exact series of their emperors years in these lodges. But such blanks may be filled by inserting some considerable incidents of history; as some few have already been in the *Latin* edition, *viz.* the building of the great wall, the burning of the books, the *Christian æra*, the introduction of the *Christian* religion into *China*, the appearance of a star (which the *Chinese* say was a sign of renewal in the world) seen in the heavens upwards of 70 days, the true year in which our Saviour was born, *&c.* If this addition please the learned; it will be no difficult matter to add several other incidents, not known in *Europe*.

The principal advantage of this table is, that in conformity with the most valued history it fixes the true *epocha* of the *Chinese* empire to 4 centuries, or thereabouts, before the birth of our Saviour. By the true *epocha* of the empire M. *Foucquet* does not mean the beginning of the nation (which is credible, as has been remarked before, remount to the next ages after the deluge) but the beginning of the monarchy; which is the time, when the incidents that happened in this nation, appearing grounded on certain truths, deserve the credit of the learned. This important point once cleared up, ought to put an end to the disputes on the fabulous antiquity of *China*.

The preternatural delivery of a Fœtus *by the* Anus; *by Mr.* Giffard; *together with an examination of the Parts; by Mr.* Nourse. Phil. Transf. N° 416. p. 435.

ABOUT the middle of *August* 1730 Mr. *Giffard* was sent for to a woman, who then judged herself to be between 3 and 4 months gone with child: She had all the symptoms preceeding a miscarriage, and upon feeling he found the *os tincæ* somewhat dilated; from whence he concluded a miscarriage would ensue; and therefore ordered what he thought proper to promote it: But he was sometime after informed by her husband, that tho' she before believed that she had miscarried, yet that she now thought herself quick, as feeling something to move within her belly, agreeable to what she had perceived after former quickenings. Thus it passed on for about 6 or 7 weeks; in which time she grew much bigger, and the motion

became

became more perceptible: So that there remained no doubt of her being with child. About the third of *October*, she was seised with violent pains in her belly and back; which increasing daily, her sister came to him on the 6th when he went to her, and found her labouring under very great pains, and other complaints like those preceeding a miscarriage, or delivery. But to be better satisfied, and to confirm his opinion, he pass'd up two fingers into the *vagina*, in order to examine, whether the *os tincæ* began to dilute. He there felt an unusual fullness and tension, which he then judged to be the body of the *uterus* sunk low into the *vagina*, and distending it much, and extending backwards and pressing against the *rectum*: So that the *fæces* could not readily pass; nor could she, from its pressure on the neck of the bladder, freely make water. Mr. *Giffard* could not find the *os tincæ*, tho' he very carefully examined all about with the ends of his fingers; wherefore, he then judged that the *fundus uteri* must have receded from its natural position, and be bent backwards towards the *rectum*; in which opinion he was the more confirmed from the fullness, he before observed, stretching backwards; and therefore concluded that the *os tincæ* must be very forward: Wherefore he endeavoured to pass his fingers between the *os pubis*, and the fullness which pressed against the upper edge of the said bone. This he effected with some difficulty; and at length about 2 or 3 inches above the said bone, he felt the *os tincæ* with the ends of his fingers. The cause of this situation will more clearly appear in the sequel of this account: He ordered the patient anodyne and quieting medicines to relieve her pains, which she was obliged to repeat at least every 12 hours, with proper cordials to support nature; and sometimes clysters. Thus matters continued to the 20th of the said month; only that for some days before, a water, tinged with blood, came away, as she imagined, thro' the *anus*; and which she believed proceeded from the piles, with which she was sometimes troubled.

On the 20. her husband came to Mr. *Giffard* about 6 o'clock in the morning, telling him that the midwife had brought away a *fœtus*, but could not compleat her business: Whereupon he immediately went to the midwife, who told him that a *fœtus* had come away thro' the *anus*; and upon examining he found the *funis umbilicalis* hanging out about 2 or 3 inches beyond the *anus*, and passing up thro' the same: He therefore pass'd his 2 fore-fingers by the string into the *anus*, when about 3 inches up he found an opening, as he then judged, into the

uterus,

uterus, wide enough to admit the ends of 3 or 4 fingers, and the *funis umbilicalis* paſſing into it; hence he was aſſured, that the *fœtus* had come out that way. With his fingers paſt into the opening he endeavoured to bring away the *placenta*; but as it was very rotten, it tore away between his fingers: So that he was obliged to draw it out in ſmall pieces, and at laſt to leave a large part of it behind. The *ſeptum* or partition between the *anus* and *vagina* was entire, and had no perforation thro' it.

From theſe appearances he then concluded, that a mortification muſt have begun in the *uterus*; and ſo from its contiguity be communicated to the *rectum*: So that nature endeavouring to expel what was contained therein, and forcing it againſt this part, already mortified, and conſequently, ready to give way and ſeparate upon any preſſure made againſt it, cauſed this opening, and the protruſion of the *fœtus* thro' it into the *rectum*; and ſo thro' the *anus*.

There was a large diſcharge of grumous blood, and other ſubſtances thro' the *anus*, which continued coming away till the 26th of the aforeſaid month, when the woman died about 3 o'clock in the afternoon.

It is to be obſerved, that there was a fullneſs and hardneſs very perceptible, to be felt outwardly in the fore-part of the belly, ſome diſtance below the navel, from the time that the *fœtus* came away to her death; which, upon opening the body, he was well aſſured was the *uterus* forced upwards and forwards by a *ſacculus*, which being large and diſtended, filled up the *pelvis*; and by its bulk preſs'd the *uterus* forwards. The *fœtus* was perfect in all its parts, but much waſted and ſhrunk from its being ſome time dead; and conſequently, putrified.

The *vagina*, *uterus*, *ligamenta rotunda*, left *ovarium*, *tuba Fallopiana* & *ligamentum latum* on that ſide, together with the hypogaſtric and ſpermatic veſſels on the ſame ſide, were in a natural ſtate. We traced the *tuba Fallopiana* on the right ſide from the *fundus uteri* almoſt to the *morſus diaboli*; where it was confuſedly united with, and opened into the *ſacculus* to be deſcribed anon. The *ovarium* on this ſide, with the *ligamentum latum*, was dilated into a large *ſacculus* of an irregular form, extending itſelf behind the *uterus* (to the poſterior paries of which it adher'd) and paſſing on towards the left, was connected with that part of the *colon* that terminates in the *rectum*, and with the *rectum*. In this *ſacculus* we found great part of the *placenta*, and the remains of lacerated membranes, beſides the aperture of the *tuba Fallopiana* abovementioned; and another about 4 inches in diameter into the middle of the *rectum*: That part of the *ureter* on the right ſide, that lies between the *ovarium* and the kidneys, was dilated; and ſo was that part of the *rectum* between the aperture into it, and the end of the *colon*; both which were caus'd from the contents of theſe canals being obſtructed in their paſſage.

Fig. 1. Plate VI. repreſents the *uterus*, with the *ſacculus* behind it, part of the *colon* and *rectum*, the *tubæ Fallopianæ*, the *ovarium* on the left ſide, the *ligamenta rotunda*, and the *vagina* laid open to the *os tincæ*; A the *uterus*; B the *tuba Fallopiana* on the left ſide; C the *ovarium* on the ſame ſide; D the *ligamenta rotunda*; E the *vagina* laid open; F that part of the *colon* that terminates in the *rectum*; G the *rectum* continued to the *anus* under the *vagina*; H the *tuba Fallopiana* on the right ſide whoſe extremity opens into the *ſacculus*, formed from the *ovarium*; I the *ſacculus* extending itſelf behind the *uterus*, wherein we found the *placenta* and ſeveral lacerated membranes, and from whence there was a large opening into the *rectum*.

Fig. 2. repreſents the inſide of the *ſacculus*, and its aperture into the *rectum*; A the inteſtine; B the *ſacculus* adhering to it; C the opening from the *ſacculus* into the *rectum*; D the membranes found within the *ſacculus*; E the *vagina* turned to the right.

A Total Eclipſe of the Moon *at* Barbadoes, July 29, 1729; *by Mr.* Stephenſon. Phil. Tranſ. N° 416. p. 441.

MR. *Stephenſon* took care to regulate a very good clock, and brought it to true time about 14 days before the eclipſe. On the day it happened, he ſaw the ſun ſet, and found the clock right according to the mean time, allowance being made for refraction. At the beginning of the eclipſe, the moon was overcaſt.

App. time h.	′	″	Phaſes.
7	18	0	2 dig. eclips'd, about 30° to the left of her nadir point.
8	11	0	The moon entirely immerged into the earth's ſhadow, about 30° to the right of her vertical point.
9	51	0	She emerged 79° or 80° to the left of her nadir point.

App.

App. time | Phases
h. ′ ″
10 50 0 The eclipse ended, 88° to the right of her vertical point.

In this and all the other observations of solar and lunar eclipses Mr. *Stephenson* made for several years in *Barbadoes*, he found they always happen'd 10 min. sooner than his computation: Whence he concludes, that *Barbadoes* lies 2° 30′ more westerly than is generally supposed.

The anatomical Preparation of Vegetables; *by* Albertus Seba. Phil. Transf. N° 416. p. 441.

ONLY those leaves of plants are fit for this purpose, whose internal structure is compos'd of woody fibres; and which are of a pretty good thickness and consistence, as the leaves of oranges, lemons, jesmins, bays, roses, cherries, apricocks, peaches, plumbs, apples, pears, poplars, pines, oaks, ivy, *&c.*

There are several other leaves which have no woody fibres, or veins; as for instance, those of vines and lime-trees; but these dissolved without separating.

Those leaves are to be gathered in *June* or *July*, when they are full grown, and have not been damaged by worms, or caterpillars: They are to be put into an earthen pot, or large glass, with a good deal of rain water, the pot, or glass, being kept uncover'd; and so expos'd to the sun, or open air: The leaves must be quite covered with water, and as it evaporates, a fresh quantity must be pour'd in. In about a month's time some of the leaves will begin to putrefy, but the others must be kept two months or longer. When the two external membranes begin to separate, and the green substance of the leaf to grow liquid; then it is time to perform the operation. The leaf is to be put into a white and flat earthen plate or dish, fill'd with clear water; then upon gently squeezing it with the finger, it will open on one side, and the green substance will run out. Immediately on that, the two outer membranes must be stript off, chiefly in the middle, and along the nerves, where they adhere closest: If there be once an opening, they will go off very easily. The skeleton that remains between is afterwards wash'd in clear water, and kept between the leaves of a book.

The method of preparing fruits, as apples, plumbs, cherries, peaches and the like, is as follows.

The fineſt and largeſt pears, that are ſoft and not ſtony, are fitteſt for this purpoſe: Firſt, they are to be nicely pared without ſqueeſing them, and care taken not to hurt the ſtalk, or the crown. This done, put them into a pot of rain, or freſh ſpring water, cover it, and let them boil gently, till they become thoroughly ſoft; then take them out and put them into a baſon of cold water; then take out one of them, and holding it by the ſtalk with one hand, and with one finger and the thumb of the other hand, rub the pulp gently off, beginning near the ſtalk, and rubbing equally towards the *apex*; and you will eaſily ſee in the water how the pulp ſeparates from the fibres, which being tendereſt towards the extremities, it is there the greateſt care is to be taken. No inſtrument is of any uſe in this operation, except laſt of all a penknife to ſeparate the pulp ſticking to the core. In order to ſee how the operation advances, you may fling away the muddy water from time to time, and pour on clean: All being ſeparated, the ſkeleton is to be preſerved in rectified ſpirit of wine. The ſame is to be obſerved with regard to apples, plumbs, peaches and the like.

Carrots and other roots that have woody fibres muſt be boil'd without paring, till they grow ſoft, and the pulp come off. Not only ſeveral ſorts of roots, but likewiſe the barks of ſeveral trees may be reduced after this method into ſkeletons, preſenting rare and curious views of vegetables.

Effects of Thunder and Lightning in Carmarthenſhire; *by Mr.* Davies. Phil. Tranſ. N° 416. p. 444.

ON the 6th of *December*, 1729, in the afternoon, there happened terrible thunder and lightning, which alarmed the whole neighbourhood; and about 4 o'clock or thereabouts, as the wife of one *William Griff. Morgan* of *Pencarreg* was carrying a pail of water into the houſe, ſhe was no ſooner come over the threſhold into a ſmall entry that leads towards the fire, than there broke ſuch a violent clap of thunder, after its fore-runner, lightning, that ſhe and three of her children were inſtantly bereav'd of their ſenſes, and lay (they know not how long) miſerable and ghaſtly monuments of the terrible ſhock; and weltring in their blood, before they recovered, and were able to creep to the bed; till the next neighbour happened to come in (the husband being then abroad) to aſſiſt them. The cauſe, whatever it was, whether thunder-bolt, thunder-ball, lightning, &c. ſtruck (it is imagined) at the eaſt end near the foundation, into the hearth, and

and cleav'd in two a thick ſtone, (commonly call'd in *Welſh Pentan)* of about half a yard in breadth beyond the fire, one part of which remain'd, and that cleft, but the other was ſhatter'd into ſmall particles and ſplinters, and thoſe ſhot into their fleſh; which (it is preſumed) did the moſt hurt. About 24 ſplinters and upwards were from time to time taken out of the wounds. It appears, that afterwards it forced its way out thro' the wall on the ſouth-ſide within the compaſs of the hearth, when it made a terrible breach from top to bottom, and remov'd the ſtones from the foundation and near it made a deep hole perpendicular in the earth; ſo that one might thruſt in a ſtaff to the wriſt. By its violence, the brandirons and the legs thereof were ſtrained; and when they endeavoured to bring them to their former poſition, they were burnt up in ſuch a manner, that they fell aſunder like ruſty iron, or worm-eaten timber. The partitions in the houſe, which were of no ſtrong materials (being wattled, as is uſual in country houſes) were mov'd out of place, and a cheſt full of corn forced down towards the door, ſome yards from the place where it had ſtood. The bucket the woman had in her hand, and the other wooden veſſels in the houſe, were all, or moſt of them ſhattered; diſhes and ſpoons, *&c.* blown off; and ſome days after, found in the garden, on the north ſide of the houſe, ſplit and broken; and ſome yarn, that was hanging in the top of the houſe, was a while after found out of doors.

The woman quite loſt her left eye; ſhe was ſpeechleſs for a week or nine days, and could not ſwallow. She had a few ſtones come out of her mouth under the tongue, and other internal parts: the tip of her tongue, as far as could be conjectured, was taken off; for ſhe ſtill liſped; three of the fore-teeth of the under jaw were broken, and the lower lip was ſlit; the ſecond and third fingers of the right hand were quite off; and the colour of that hand was like a flame of fire; as if ſome igneous particles remain'd in it. She had ſuch a terrible gaſh upon the right ſhoulder between the joints, that one might have covered an egg therein; and withal very painful; and ſhe had three or more bruiſes upon that arm down to the wriſt, ſo that ſhe was not able to heave or lift it up, without the help of the other hand; as alſo ſeveral other wounds and bruiſes over great part of her body. A boy had his hair all ſinged, his face and breaſt all ſcorch'd

with

with bliſters, like bladders, running from the raw fleſh, with ſeveral ſplinters of ſtones taken out of his body and legs; and two other ſmall children ſuffered greatly: So that the wounds were reckoned to be 30 at leaſt, between the mother and children: Only one girl about 10 years of age, that ſtood at a diſtance next the doors, eſcap'd, having her cloaths only ſinged, and no hurt done her. There were ſeveral ſplinters of bones taken out in dreſſing their wounds. It is alſo worth obſerving, that they ſmelt ſo ſtrong of the ſulphur and bituminous matter for ſome days, that one could hardly bear it. They now are free from any grievous pain; ſo that they go about.

An Account of the Operation of Bronchotome; *by Dr.* Martin. Phil. Tranſ. N° 416. p. 448.

A Young lad being in a good ſtate of health, was all of a ſudden taken ill with a violent pain in his throat; in which, however, Dr. *Martin* could ſee nothing amiſs, the *amygdalæ*, and other parts in view, being in all appearance ſound enough, only looking a little dryer than ordinary; without any external tumour appearing about the *larynx*, and no conſiderable frequency or ſtrength in his pulſe. But he had great pain, and a *dyſpnœa*, together with an impoſſibility of ſwallowing either liquids or ſolids, every thing returning forcibly by the mouth or noſe, when he made an effort to get it down. From all which the Dr. reckoned it an *angina* of the worſt kind (*ſine apparente tumore* vide *Hippocr. Prognoſt.* XXIII. 3. & *Prænot. coac.* iii. 96.) and the ſeat of the diſeaſe in the *larynx* and fibres common to it and the top of the gullet,

Notwithſtanding repeated bleedings, bliſtering between his ſhoulders, cupping, &c. the diſeaſe continued ſo obſtinate, and the patient ſo like to be ſuffocated, that next day in the afternoon his friends, tho' very averſe in the morning, when the Dr. firſt propos'd piercing the wind-pipe, at length earneſtly deſired that the operation might be performed. We directly ſet about the operation, which was done with ſuch ſucceſs, that in leſs than four days, his breathing being perfectly eaſy, and his deglutition almoſt ſo, we remov'd the *canula*, and left the *glottis* to do its own office.

According to *Cælius Aurelianus*, *Acut.* III. 4. and the author of the *liber introductorius cap.* 13. aſcrib'd to *Galen*, *Bronchotomy* was propoſed by *Aſclepiades* (however inconſiſtent

ſiſtent with his delicacy, and the reſt of his character, the ſeeming harſhneſs of this operation may appear) and is deſcribed and earneſtly recommended by almoſt all the ſyſtematical writers of ſurgery from *Paulus* of *Ægina, de re Medic.* VI. 33. and as he ſays, *Antyllus*, and ſome others of the beſt ſurgeons before him, down to the preſent times.

But when they are at ſo much pains to defend the reaſonableneſs of it, and when they ſhew ſo much fondneſs of citing and telling examples of the healing accidental wounds of the *trachæa*, without ever mentioning their own regular performances of the operation (which would have been a ſhorter, and much more effectual recommendation of it) when the Dr. conſiders all this, he finds himſelf obliged to think, that it has very ſeldom been reduced to practice. So rare had it been, that *Aretæus*, a man of vaſt judgment and ſkill in diſeaſes, *Cur. Acut.* I. 7. thought the operation had never been actually performed with ſucceſs. And *Cælius Aurelianus* look'd on it as an impracticable whim of *Aſclepiades*. Neither *Avenzoar Medic.* I. x. 14. nor *Albucaſis, Chirurg.* ii. 43. knew any of their countrymen, who had undertaken it. And the *Arabians* are reputed to have been hardy ſurgeons enough. The moſt the Dr. knows amongſt them of this kind is in *Avenzoar*, who tried the experiment on a goat, and cured the wound, which ſhews the ingenuity and induſtry of the author: For, as to what one may find in ſome writers, that *Raſes Contin.* VII. *Fol.* m. 77. ſaw *Andruſius* the phyſician perform it (the copy the Dr. look'd into, printed at *Venice* 1505, calls him *Ancilifius*; and probably, it ſhould be *Antyllus* for them both) he thinks this is owing to a miſtaken interpretation of that author's meaning. If one read the whole context, he will eaſily conceive, that all he ſays of the operation is upon hearſay; and conſequently, that he had only ſeen in books, that ſuch a one had performed it. That moſt accompliſh'd anatomiſt and ſurgeon *Fabricus ab Aquapendente, Operat. chirurg.* XLII. p. 477. frankly acknowledges, that neither he nor any of his cotemporaries had ever ventured to perform it. Neither does his ſucceſſor, in the profeſſion of ſurgery, and his rival in anatomy, *Julius Caſſarius* of *Placentia de voc. org.* I. 20. pretend to have done it; tho' he has endeavoured to illuſtrate the operation by ſome very neat figures; which you will not readily ſuſpect to be from any but dead bodies. And next to him M. *Aurelius Severinus, Chirurg. effic.* ii. 40. who was a very judicious and

and learned man, and the best and boldest surgeon of his time; tho' he recommend it with a great deal of warmth and keenness, yet it seems even in his latter days, he never had occasion to try it: So that the first undoubted and distinctly recorded history the Dr. can find of this operation being actually practis'd, is in the learned *Anton. Musa Brasavolus*, *Com. in Hippocr. de diæt. in acut.* IV. 35. who performed it in a desperate squinance, when the surgeon refus'd to do it; and repeated it again in the like case. M. *Arnaud* performed it, but his patient died, vide *Garangeot. operat. chirurg.* XXXII p. 489. However M. *Binard* had better success, *Garangeot* *ibid.* XXXII. p. 498. Dr. *Friend Hist. physic. l.* p. 206 cites *Purman*, performing it; and tells us p. 207. of another case communicated to him by a surgeon, whom he does not name. And besides these, Dr. *Martin* believes there are but few instances can be produced of any who really performed the operation on a living person. But he heard that one Mr *Baxter*, a surgeon in *Coupar* of *Fife*, and Dr. *Oliphant* in *Gask* in *Perthshire*, did it with very good success within these few years.

In the actual performance of the operation they certainly did, or might have observ'd some things omitted by authors; and even some not perfectly agreeing with the common accounts given of it. Dr. *Martin* thinks it worth observing, that in the very cutting, before he got a free passage into the *trachæa*, and the *cannula* was introduced, the patient felt some relief; which he thought might be ascrib'd to the effusion of blood in the operation; a small quantity evacuated so near the part affected, could not, according to the true laws of hydraulics, and the observations and practice of the ancients (however disagreeing with *Bellini*'s theory) but make a more considerable revulsion, than a much greater quantity taken away at a great distance: Whence the judicious *Fab. ab Aquapendente* p. 480. with very good reason suppos'd that by the derivation here, the patient would be more apt to feel some relief than trouble; which *Julius Guastavinus* likewise made no doubt of in his dispute upon this subject against *Aretæus*, vide M. *Aur. Severin.* p. 103. And now their supposition and conjecture is confirmed by experience: And since there continued a greater flux of blood to the wound while it was suppurating, Dr. *Martin* reckoned the circulation in the muscles of the *larynx* to be with less force than ordinary; and so probably to contribute to diminish the

strength

ſtrength of the voice, which, for a good many days after the operation, was obſerv'd to be much weaker than it us'd to be. Which he all along took to be rather owing to this, and the lowneſs of the patient's body by his ſlender diet, *&c.* than to any hurt done the recurrent nerves; which being cut, do, it is true, deſtroy the voice; but by their deepneſs are in leſs hazard than ſome in old times us'd to think.

In performing the operation on a living perſon, one cannot but remark at the very firſt, that the *cannula* ſhould not be made near ſo ſhort, as is commonly propos'd in books, and chirurgical lectures: For, he found that upon cutting the parts, eſpecially the thyroid gland (which is not ſo much minded in moſt of the common deſcriptions of this operation, as it ſhould be) they ſoon become tumified in ſuch a manner, as to require a *cannula* above an inch long, to penetrate ſufficiently into the *aſpera arteria*; which is more than double *Garangeot*'s allowance of ſix lines; one of the lateſt writers, and who has communicated to us all the ſurgery the *French* are maſters of. The *cannula* made uſe of was too long and too ſmall, being the common *cannula* for tapping in the dropſy, flatten'd a little at the end, and hindered by a very thick compreſs, perforated in the middle, from penetrating too deep into the *trachæa*.

The mucous particles and ſteams, ariſing from the lungs, caus'd a continual weeping of a thin ſlavery liquor from the mouth of the *cannula*; part of which thickening and ſtuffing its cavity, did ſometimes thereby very much incommode the patient's reſpiration: So as to render it neceſſary to have it taken out and cleaned. And hence when ſome moderns very preciſely bid us put a thin ſlice of ſponge, or a bit of muſlin, &c. cloſe over the orifice of the *cannula*, to prevent the ingreſs of duſt, down, &c. into the lungs; it confirms what the Dr. ſaid before of the unuſualneſs of the operation; and looks as if they had only conſider'd the matter in the abſtract, without conſidering they had not to do with a pure thin dry air, but with a heterogeneous fluid, moiſtened and thickened with viſcid particles, apt to run together into ſtiff concretions. And therefore, tho' it muſt be acknowledged, that there would have been leſs hazard of a ſtoppage, if the *cannula* had been ſhorter, and wider, eſpecially at the mouth. The Dr. cannot but think it an ingenious propoſal of one of their miniſters, to make the *cannula* double, or one within another, that the innermoſt might ſafely and eaſily be taken out, and clean'd when neceſſary, without any moleſtation to the patient: For, it is n[o] ſmall trouble to him to have the bandage frequently remov'[d] and the *cannula* fitted a new to the orifice, made in the *tra[-] chæa.*

And indeed he found no inconveniency in the patient['s] breathing the air, as it paſs'd thro' the *cannula*, without an[y] cleanſing or intercepting medium, tho' the houſe was none [of] the cleaneſt. But if by a larger, and conſequently a mor[e] patent *cannula*, a patient, eſpecially one of more delicat[e] and ticklish lungs, ſhould be incommoded that way, the D[r.] thinks the ingreſs of duſt, &c. might conveniently enough b[e] hindered by a piece of muſlin, or thin hair crape, tied loo[ſe] about the neck over the orifice of the *cannula*; in ſuch a ma[n-] ner, however, as not to touch it, or be wetted by the liqu[or] coming from it.

The patient was ſoon perfectly recovered: He breathe[d] ſpoke, eat, drank, and performed all the other functions [of] life, and went about his calling as formerly. And here th[e] Dr. cannot but take notice of the needleſs pain ſome write[rs] are in about healing up the wound by bandaging, ſtitching, &c. For, we found it fill up eaſily of itſelf in a very fe[w] days, by only dreſſing it every other day or ſo, with a ſo[ft] tent, made leſs and leſs every dreſſing, and armed in th[e] common way with *Liniment. Arcæi.* The Dr. believes in[-] deed, it would have taken a little more time to heal, had th[e] patient been older.

Occultations of ſeveral fixed Stars, obſerv'd at Pekin *i[n]* 1728, 1729. Phil. Tranſ. N° 416. p. 455. *Tranſlate[d] from the* Latin.

NOvember 20. at $5^h\ 0'\ 42''$ in the morning the moo[n] covered *ν* of *Leo*; the place of the immerſion was nearl[y] over againſt *Rocca.*

At $6^h\ 21'\ 55''$ the ſtar emerging was in a right line with *Reinholdus* and *Grimaldus*; conſequently the place of the emerſion was near *Beroſus*, and the tranſit almoſt central.

March 8. 1729. at $11^h\ 18'$ p. m. the moon covered the north eaſt ſtar of the *trapezium*, which is below the feet of *Auriga*; at $12^h\ 12'$ the ſtar emerged over againſt *Meſſala.*

March 11. at $7^h\ 56'\ 3''$ in the evening the moon covered *η* of *Cancer*; the place of immerſion was over againſt *Schick-*

ardus;

ardus: The emersion which was over against *Petavius*, was observ'd a little later than $9^h\ 2'\ 30''$; but it should have happened at $8^h\ 59'$ nearly.

April 2. in the evening the moon was in conjunction with the *Pleiades*. At $8^h\ 23'\ 2''$ the moon covered the more northerly little star of the equilateral triangle, which preceeds the *Pleiades*: The place of the immersion was over against *Phocyllus*. At $9^h\ 2'\ 23''$ she absorbed the bright star, which is above the *Pleiades*, almost in a right line with *Taygetes* and *Electra*: The place of the immersion seemed to be over against *Cardanus*. At $9^h\ 9'\ 25''$ the moon covered *Taygete*, whose immersion was over against *Cabæus* near the southern cusp of the moon. At $9^h\ 18'\ 58''$ the preceeding star of *Sterope* immerged over against *Bartolus*. At $9^h\ 25'\ 27''$ the following star near *Casatus* immerged.

The emersions could not be observ'd by reason of the excessive undulation of the lucid limb of the moon.

April 11. at $8^h\ 12'$, p. m. the moon covered ν of *Leo* directly over against *Schickardus*, *Messala* being at the moon's vertex.

At $9^h\ 11'\ 30''$ the star emerged a little below *Langrenus*, *Mercury* being at the moon's vertex.

November 11. in the morning the moon's transit over the *Pleiades*, together with the occultation of the northern stars, was observ'd as follows.

h.	′	″	
4	51	10	*Celæno* immerged over against *Zucchius*.
4	53	6	*Taygete* immerged over against *Crugerus*.
5	17	30	The bright star of *Sterope* immerged above *Ricciolus*.
5	18	20	*Maja* immerged over against the western edge of *Schickardus*.
5	21	0	The star following *Sterope* immerged over against *Rocca*. doubtful
5	37	10	*Celæno* emerged in a right line over against *Petavius*.
6	2	20	*Taygete* emerged between *Langrenus* and *Mare Crisium*.
6	15	30	*Maja* emerged to the north of *Wendelinus*.

The emersion of *Sterope* could not be observ'd by reason of the twilight.

The ſame day at $7^h\ 30'\ 34''$ in the evening χ of *Taurus* was covered by the moon a little below *Galilæus*; and at $8^h\ 33'\ 15''$ it emerged again a little above *Langrenus*,

A Conjunction of Saturn *with the* Moon, *obſerv'd at* Pekin December 6. 1728, *N. S.* Phil. Tranſ. N° 416. p. 456. *Tranſlated from the* Latin.

DEC. 6. in the evening *Saturn* was in conjunction with the moon; but the moon not appearing from under the clouds till after $7^h\ 15'$, there were taken only the following diſtances of *Saturn* from the nearer limb of the moon, whoſe diameter was $30'\ 45''$.

At $7^h\ 0'\ 18''$	dist.	$17'\ 55''$	Saturn being in a right line paſſing from the N. cuſp of the moon thro'	*Fracaſtorius.*
25		20 30		*Iſidorus.*
33		23 0		*Santbecius.*
40		25 10		*Petavius.*

Eclipſes *of* Jupiter's Satellites *obſerv'd at* Pekin, *in* 1728, 1729. Phil. Tranſ. N° 416. p. 457. *Tranſlated from the* Latin.

Immerſions of the I Satellite.

		D.	H.	M.	S.	
1728	*Nov.*	5	1	42	45	in the morning.
		12	3	36	15	in the morning.
		13	10	4	10	in the evening.
		19	5	28	20	in the morning.
		20	11	55	59	in the evening.
		28	1	47	50	in the morning.
		29	8	16	35	in the evening.
	Dec.	6	10	8	0	in the evening.
		12	5	30	45	in the morning.
		15	6	27	0	in the evening.
		22	8	17	0	in the evening.

Emerſions of the I Satellite.

1728	*Dec.*	31	6	50	15	in the evening.
1729	*Jan.*	7	8	40	40	in the evening.
		16	5	0	0	in the evening.
		22	0	24	10	in the morning.
		23	6	52	20	in the evening.
		30	8	46	15	in the evening.

		D.	H.	M.	S.	
1729	*Feb.*	15	7	5	0	in the evening.
	Mar.	10	7	21	40	in the evening.
		17	9	19	50	in the evening.
		24	11	16	15	in the evening.

Immerſions of the I. Satellite.

Nov.	1	2	58	45 in the morning.
	15	6	45	0 in the morning.
	17	1	12	15 in the morning.

Immerſions of the II. Satellite.

	Nov.	6	6	8	45 in the morning.
1729	*Dec.*	1	3	3	20 in the morning.
		8	5	35	55 in the morning.
		18	9	25	0 in the evening.

Emerſions of the II. Satellite.

Jan.	2	5	21	30 in the morning.
	5	6	37	0 in the evening.
	19	11	44	15 in the evening.
	27	2	20	0 in the morning.
Feb.	6	6	14	18 in the evening.
	13	8	49	0 in the evening.
	20	11	28	45 in the evening.
Mar.	10	6	9	0 in the evening.
	17	8	49	40 in the evening.
	24	11	30	10 in the evening.
May	20	8	49	30 in the evening.

Immerſions of the II. Satellite.

Nov.	17	11	52	25 in the evening.

Immerſions of the III. Satellite.

1728	*Nov.*	6	10	4	10	in the evening it diſappear'd being entirely immerged.
		7	0	47	15	in the morning; it began to emerge again.

	D.	H.	′	″	
1728	21	6	1	5	in the morning; entirely immerged.
1729 *Jan.*	24	5	24	20	in the evening; it diſappeared being entirely immerged.
	24	8	21	40	in the evening; it again began to emerge.
	31	9	25	36	in the evening; entirely immerged.
1729 *Feb.*	1	0	21	0	in the morning; it began to emerge again.
Mar.	15	9	33	0	in the evening; entirely immerged.

Immerſions of the IV. Satellite.

1729 *Jan.*	16	6	30	0	about evening; it immerged.
	16	9	24	0	in the evening; it began gradually to emerge again.
Mar.	24	6	46	20	in the evening; it entirely diſappeared.
	24	10	10	20	in the evening; it began to emerge again.

A Total Eclipſe of the Moon *obſerved at* Pekin Feb. 14. 1729, N. S. Phil. Tranſ. N° 416. p. 460. *Tranſlated from the* Latin.

ALL that night it continually ſnow'd a little; but the heavens being ſo thinly overcaſt, the lunar *maculæ* could in ſome meaſure be frequently diſtinguiſhed; tho' more rarely, and with greater difficulty at the time of the immerſion: About the time of the emerſion the ſky gradually cleared up, ſo that now about the end of the eclipſe it was quite without a cloud.

The clock was corrected by altitudes of *Arcturus* and *Aquila*, as alſo by culminations of *Spica Virginis* and the north ſcale of *Libra*. At the beginning of the eclipſe, the moon's diameter, meaſur'd with the micrometer, was 32′; *Pythagoras* and *Helicon* were in a vertical line to the moon's center.

Time a. m.			Phaſes
h.	′	″	
2	38	30	The beginning of the eclipſe over againſt *Hevelius*.
	41	0	The ſhadow at *Grimaldus*.

Time

Time a. m. h.	′	″	
2	42	30	*Grimaldus* entirely immerged.
	43	0	*Galilæus.*
	47	0	The shadow at *Ariſtarchus.*
	48	30	*Keplerus.*
	50	0	*Gaſſendus.*
	58	0	*Copernicus.*
3	3	30	The shadow at The more eaſterly *ſinus æſtuum.*
	9	0	*Tycho.*
	17	30	*Menelaus.*
	24	30	*Poſſidonius* entirely immerged.
	26	0	*Fracaſtorius.*
	31	0	The ſhadow at *Proclus.*
	32	0	*Mare Criſium.*
	35	30	*Langrenus.*
	39	0	The total immerſion between *Langrenus* and *Mare Criſium.*
5	17	10	The firſt emerſion of light below *Grimaldus.*
	21	0	*Grimaldus* begins to emerge.
	22	25	Entirely emerged.
	28	0	*Gaſſendus* emerged.
	30	35	*Keplerus.*
	36	40	The ſhadow at the centre of *Tycho.*
	37	20	*Tycho* entirely emerged.
	40	35	*Copernicus.*
	46	28	*Plato* begins to emerge.
	48	30	Entirely emerged.
	50	0	*Sinus æſtuum*
	53	50	*Archytas*
	55	20	*Manilius*
	57	15	*Ariſtoteles* emerged.
	58	45	*Menelaus*
	59	10	*Ariadæus*
6	0	50	*Fracaſtorius*
	2	30	¼ of the moon's diameter remains in the ſhadow.
	2	50	*Plinius*
	5	45	*Poſſidonius*, *Vitruvius* and *Cenſorinus*
	10	0	*Taruntius* emerge.
	10	30	*Proclus*
	13	10	*Langrenus* entirely emerged.
	13	30	*Mare Criſium* begins to emerge.
	16	30	Entirely emerged.

Time

Time a. m.
h. ′ ″
6 17 40 The end of the eclipse over against *Mare Cri-
sium, *Oenopides* and *Heraclides* being at th
time in a vertical line to the moon's centre.

A Description of the Cereus Peruvianus *flower'd at* Norimbe
in 1730; *by Dr.* Christopher James Trew. Phil. Tran
N°. 416. p. 462.

THIS *Cereus* is 6 foot 3 inches high, and 13 inches thic
It has 7 angles at its base, 8 about the middle, and
near the top. Its upper part is of a sea-green, from the powd
with which it is covered; its lower, is of a grass-green. Th
down of its prickles is between pale and white about the to
every where else it is brown.

Sept. 5. 1730, at the height of 6 feet 2 inches from th
ground, it shot a round knot from its trunk, which so encreas
and extended almost horizontally, that on the 14. of the sam
month, it was 8 inches long, and plainly shew'd a flower, th
still close, embellish'd with a beautiful mixture of green, pu
ple, and white. The same evening the flower began to ope
and continued till midnight; when being entirely spread, it wa
6 inches in diameter. It was of a pretty strong, but not ver
pleasant smell. After midnight it gradually contracted about
an inch; and continued so till next day at noon: Then it bega
to contract faster, to half the diameter of the expanded flowe
and the next morning it was quite closed and wither'd; bu
hung on the trunk till *Sept.* 30. The beginning of the flow
was a tube 3 inches long, not quite an inch thick, between
yellow and a pale green. Its surface was channell'd with sma
narrow furrows, between which obtuse protuberances were ob
served to run, in a parallel order along the ridges. Where th
tube expanded itself, it divided into more than 40 petaloid seg
ments, ranged in 6 separate series; the 3 inferior and exteri
here and there confounded their order, while the 3 superior an
interior remained regular and unmix'd. These series were di
tinguished by their size and colour. The first or exterior wa
of the same colour with the tube, *viz.* of a pale green, but i
upper part gradually inclined to a purple, the second and thir
had half the inner part greenish, and the edges of a deepe
purple; the 4th was between yellow and white, terminating i
purple tops; the tops of the 5th were likewise purplish; th
petaloid segments of the 6th were very tender and white: Th
segmen

ſegments were of an oblong figure, and in the firſt ſeries terminated with obtuſe, in the others with more and more pointed tops; the inner or ſixth ſeries, which contained 13 of theſe ſegments, exhibited all the edges finely and lightly, but irregularly cut and divided. The *piſtillum* of equal height with the ſurface of the flower, and hollow like a ſmall tube, ran, at its upper end, into as many fine pale filaments, ſpread in the form of a crown, as there were ſegments in the inmoſt row, the day before the flower dropp'd from the *ovarium*; the place where it was to ſeparate was marked by a blackiſh circle, at which the tube ſeparated ſpontaneouſly from the *ovarium* or *matrix*, that is, the rudiments of the fruit; the *piſtillum* ſtill firmly adhering to the *ovarium*. The flower now fallen, being diſſected lengthwiſe, the origin of the *ſtamina* lay open to the eye; and it very plainly appeared that the petaloid ſegments of the flower, far from affording the leaſt mark of a natural partition, ſtuck ſo very cloſe to the tube, that not one of them would quit it without tearing it off with violence.

The fruit, tho' it did not come to its full growth, plainly evinced by inſpection alone, that it is not prickly. Upon diſſection it afforded a viſcous juice; and within was a cavity, the ſides of which were every where, except at the bottom, thick ſet with a vaſt many ſmall *villi*, to each of which hung an oblong, white, pellucid veſicle, which is the rudiment of the future ſeed.

A Deſcription of the Water Works *at* London Bridge; *by* *Mr.* Beighton. Phil. Tranſ. N° 417. p. 5.

THE wheels are placed under the arches of *London-bridge*; and mov'd by the common ſtream of the tide water of the river *Thames*.

A B (Fig. 3. Plate VI.) repreſents the axle-tree of the water-wheel, 19 foot long and 3 foot in diameter; C, D, E, F are 4 ſets of arms, 8 in each place, on which are fixed G G G G, 4 rings, or ſets of felloes, 20 foot in diameter, and the floats H H H, 14 foot long and 18 inches deep, being about 26 in number.

The wheel lies with its 2 gudgeons or centres, A, B, upon 2 braſſes in the pieces M N, which are 2 large levers, whoſe *fulcrum*, or prop is an arch'd piece of timber, the levers being made circular on their lower ſides to an arch of the radius M O, and kept in their places by 2 arching ſtuds, fixt in the ſtock L, thro' 2 mortiſes in the lever M N.

By these levers the wheel is made to rise and fall with the tide, which is performed in the following manner. The levers MN are 16 foot long; from M, the *fulcrum* of the lever, to O the gudgeon of the water wheel, 6 foot; and from O to the arch at N, 10 foot. To the bottom of the arch N is fix'd a strong triple chain P, made in the fashion of a watch-chain, only the links arch'd to a circle à foot in diameter, with notches, or teeth, to take hold of the leaves of a pinion of cast iron Q, 10 inches in diameter, with 8 teeth in it moving on an axis. The other loose end of this chain has a large weight hanging to it, to help to counterpoise the wheel, and preserve the chain from sliding on the pinion. On the same axis is fixt a cog-wheel R, 6 foot in diameter, with 48 cogs: To this is applied a trundle or pinion, S, of 6 rounds or teeth; and upon the same axis is fixt T, a cog-wheel of 51 cogs, into which the trundle V, of 6 rounds, works; on whose axis is a winch or windlass, W, by which one man, with the two windlasses, raises or lets down the wheel, as there is occasion.

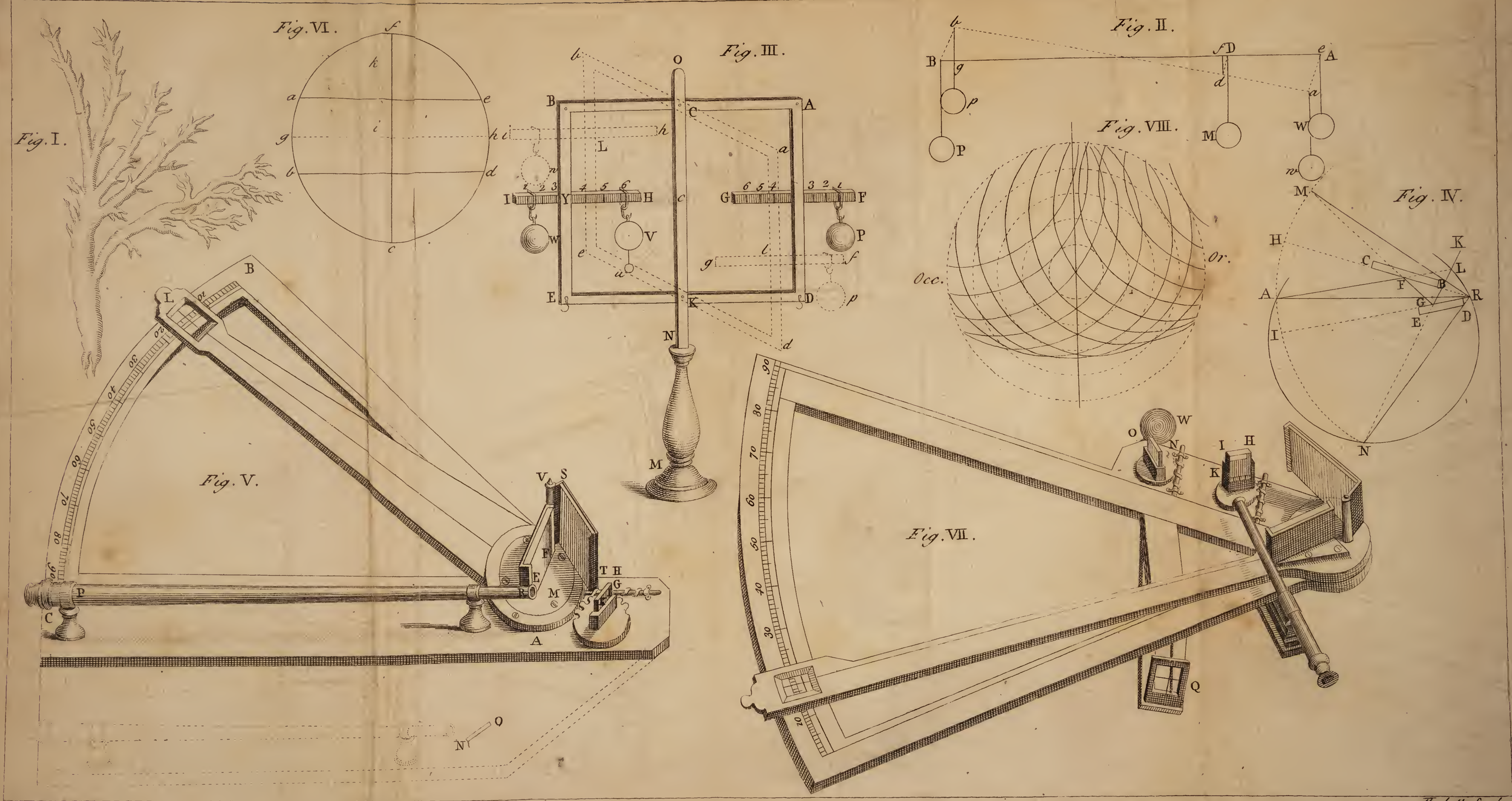
And because the *fulcra* of these levers, MN, are in the axis of the trundle K, *viz.* at M or X, in what situation soever the wheel is raised or let down, the cog-wheel II, is always equi-distant from M, and works or geers truly.

By means of this machine the strength of an ordinary man will raise about 50 ton weight.

II is a cog-wheel fixt near the end of the great axis, 8 foot in diameter, and 44 cogs working into a trundle K, 4 foot and ½ in diameter, and 20 rounds, whose axis or spindle is of cast iron 4 inches in diameter, lying in brasses at each end, as at X.

ZZ is a quadruple crank of cast iron, the metal being 6 inches square, each of the necks being turned one foot from the centre, which is fixt in brasses at each end in two head-stocks fastened down by caps. One end of this crank at Y is placed close abutting to the end of the axle-tree X, where they are at those ends 6 inches in diameter, each having a slit in the ends where an iron wedge is put, one half into the end X, the other half into Y, by means of which the axis X turns round the crank ZZ.

The 4 necks of the crank have each an iron spear, or rod fixt at their upper ends to the respective libra or lever, *a* 1, 2, 3, 4, within 3 foot of the end. These levers are 24 foot long moving on centres in the frame *bbbb*; at the end of which, at *c*, 1, 2, 3, 4, are joined 4 rods with their forcing plugs, working into *d* 1, 2, 3, 4, four cylinders of cast iron 4 foot ¾ long, inche



del. Hulett Sculp

inches bore above, and 9 below where the valves lie, faſtened by ſcrew'd flanches, over the 4 holes of a hollow trunk of caſt iron, having 4 valves in it juſt over *e e e e*, at the joining on of the bottom of the barrels, or cylinders; and at one end a ſucking pipe and grate *f*, going into the water, which ſupplies all the 4 cylinders alternately.

From the lower part of the cylinders *d* 1, *d* 2, *d* 3, *d* 4, come out necks turning upward archwiſe, as *g g g g*, whoſe upper parts are caſt with flanches to ſcrew up to the trunk *h h h h*; which necks have bores 7 inches in diameter, and holes in the trunk above, communicating with them, at which joining are placed 4 valves. The trunk is caſt with 4 boſſes, or protuberances, ſtanding out againſt the valves to give room for their opening and ſhutting; and on the upper ſide are 4 holes ſtopped with plugs, to take out on occaſion, to cleanſe the valves. One end of this trunk is ſtopped by a plug *i*; to the other, iron pipes are joined, as *i* 2 by flanches, thro' which the water is forced up to any height, or place required.

Beſides theſe 4 forcers, there are 4 more, placed at the other ends of the *libræ*, or levers (not ſhewn in the Fig. to avoid confuſion, but to be ſeen on the left hand) the rods being fixt at *a* 1, 2, 3, 4, working in 4 ſuch cylinders, with their parts *d d*, &c. *e e*, *f*, *g g*, and *i*, as before deſcribed, ſtanding near *k k*.

At the other end of the wheel at B, is placed all the ſame ſort of work, as is deſcribed at the end A, *viz.*

The cog-wheel I	The 4 levers *a c*, *a c*, &c.
The trundle K	8 forcing rods *a d*, *a d*, &c.
The ſpindle X	8 cylinders *d e*, *d e*, &c.
The crank Y, Z	4 trunks, as *e e*, *h h*, &c.
The ſucking pipes *f*	2 forcing pipes, as *i*.

So that one ſingle wheel works 16 pumps.

All which work could not be drawn in one perſpective view, without rendering it very much confus'd.

The following is a calculation of the quantity of water rais'd by the engine at *London-bridge*.

In the firſt arch next the city is one wheel with double work of 16 forcers.

In the third arch	first wheel double work at one end, and single at the other	12
	second wheel in the middle	8
	third wheel	16
	In all	52 forcers

One revolution of a wheel makes in every forcer $2\frac{1}{5}$ strokes

So that one turn of the 4 wheels makes 114 strokes

When the river is at best, the wheels go six times round in a minute, and but $4\frac{1}{2}$ at middle water 6

The number of strokes in a minute 684

The stroke 2 foot and $\frac{1}{2}$, in a 7 inch bore, raises 3 Ale Gallons

They raise *per* minute 2052

That is, 123120 gallons = 1954 hogsheads *per* hour, and at the rate of 46896 hogsheads in a day, to the height of 120 foot.

This is the utmost quantity they can raise, supposing there were no imperfections or loss at all.

But it is certain from the following considerations, that no engine can raise so much, as will answer the quantity of water the cylinder contains, in the length of the forcer, or piston's motion: For,

1. The opening and shutting of the valves lose nearly so much of that column as the height they rise and fall.

2. No leather is strong enough for the piston; but some water must continually slip or squeeze by, when it is raised to a considerable height; and when the column is short, it will not press the leather enough to the cylinder, or barrel: But especially at the beginning, or first moving of the piston, there is so little weight on it, that before the leather can expand, there is some loss.

3. And this loss is more or less, as the pistons are looser or tighter leather'd.

4. When the leathers grow too soft, they are not capable of sustaining the column to be raised.

5. If they be leather'd very tight, so as to lose no water; then a great part of the engine's force is destroyed by the friction.

By

By ſome experiments Mr. *Beighton* accurately made on engines, whoſe parts are large and very well executed, they will loſe $\frac{1}{5}$ and ſometimes $\frac{1}{4}$ of the calculated quantity.

However the perfections or errors of engines are to be compared together by the calculated quantities or forces; For, as they differ in thoſe, they will proportionably differ in their actual performances.

The power by which the wheels are moved is, as follows.

The weight of the column of water on a forcer 7 inches in diameter, and 120 foot high.

7×7=49 *lb.* the pounds *aver.* in a yard nearly
40 yards high

1960 *lb.* on one forcer
8 forcers always lifting

The whole weight on the engine at once } 15680 *lb.* = 140 Ct = 7 tun weight

Then the crank pulls the *libra* 3 foot from the forcer, and 8,3 feet from the center.

7 tun
× 11,3

8,3) 79,1 (9,5 tun on the crank. tun
Wallower 2,2) 9,5 (4,3 on the trundle
The ſpur-wheel 4

The radius of the great wheel 10) 17,2 (1,72 tun
20

The force on the floats 18 Ct 40 *lb.* 34,40 Ct

But to allow for friction and velocity, may be reckoned 1 $\frac{1}{2}$ tun.

The ladles or paddles 14 foot long, 18 inches deep } = 22,4 ſquare feet.
The fall of water is ſometimes 2 feet

44,8
6 Gall. in a cubit foot
) 268,8
10 *lb.* in a Gall.
112) 2688 (24 hundred.

The

The velocity of the water 4 foot in 21‴ of time.

21‴ : — 4 feet : : — 60″ : — 685 feet *per* minute.

The quantity expended on the wheel, according to the velocity of the ſtream 1433 hogſheads *per* ſecond.

But at the velocity of the wheel 645 hogſheads *per* ſecond.

The velocity of the wheel to the velocity of the water, as 1 to 22.

Mr. *Beighton* makes the following obſervations on theſe water-works.

Tho' they may be juſtly eſteem'd as good as any in *Europe*; yet there are ſome things, as he conceives, which might be alter'd very much for the better.

1. If inſtead of 16 forcers they worked only 8, the ſtroke might be 5 foot in each forcer, which would draw a great deal more water with the ſame power on the wheel: For, then there would be but $\frac{1}{2}$ the opening and ſhutting of valves; conſequently, but half that loſs: And a 5 foot ſtroke draws above double the quantity of 2 ſtrokes of 2 foot and $\frac{1}{2}$ each, by near $\frac{1}{5}$, in regard the velocity is double; which is the moſt valuable conſideration in an engine, where the pipes will ſuſtain ſuch force.

2. The bores that carry off the water from the forcers are too ſmall; there being (nearly) always 2 columns of 7 inches diameter, forcing into one pipe of the ſame diameter, and $7\times7=49+49=98$.

Therefore, thoſe pipes of conveyance ſhould be near 9 inches in diameter.

The timber-work is all admirably well executed; and the compoſition and contrivance, both for ſtrength and uſefullneſs, not exceeded by any he has ſeen.

The cranks of caſt iron are better than of wrought iron; by reaſon they are very ſtiff, and will not be ſtrained, but ſooner break; and then they are cheap, and new ones eaſily put in.

The wedge for putting on, or releaſing the crank, and forcers, is better than the ſliding ſockets, commonly made uſe of.

The forcing barrels, trunks, and all their *apparatus*, are very curiouſly contriv'd for putting together, mending, altering or cleanſing, and ſubject to as little friction as poſſible in that part.

The machine for raiſing and falling the wheels is very good, tho' but ſeldom us'd, as he is informed: For, they will go at almoſt any depth of water, and as the tide turns, the wheels go the ſame way with it.

Theſe

These engines at *London-bridge* are far superior to those so much famed at *Marly* in *France*, in regard the latter are very ill design'd in their cranks, and some other parts.

A Stone *broken in the* Bladder, *and voided thro' the* Urethra; *by Dr.* Heister. Phil. Trans. N° 417. p. 13. *Translated from the* Latin.

ONE *Widmannus*, chief oeconomist of the secular monastery of *Marienthal*, in the territory of *Brunswick*, a man upwards of 60 years of age, but robust, and wont to live hard, had at first for several years been troubled with frequent and violent fits of the stone in the kidneys, and at times voided thro' the *urethra*, not without exquisite pain, a large quantity of *calculi*, several of which were bigger than a pea: But at length, namely 4 years since, he felt all the symptoms of the stone in the bladder; so that when he made water, it was with a most exquisite pain in the region of the *pubis* and *perinœum*. In 1728, after he had for some time us'd several medicines, especially the *tinctura anti-nephritica*, *Lipsiensis* or *Rothiana*, as they call it, and at the same time constantly used for his ordinary drink that kind of beer (famous in these parts for the stone) brewed at *Koenigs-Lutter*, a town in *Brunswick*, and called *Duchstein*, and upon that account exported into foreign countries, he sometimes felt violent pains in making water, a *nisus* and a constriction in the bladder, and as if one or more *calculi* were broken and split therein: Upon which he immediately voided with his water some bits of a broken *calculus*, which for several days after were followed by others; till at length by voiding them, he is now healthy and strong and free from *calculi* and all pain. The different colour of the several pieces, some of which were of a duskish and others of a yellowish hue, somewhat resembling sulphur, plainly shews that this patient had several *calculi* at the same time, and those bigger than that they could pass whole thro' the *urethra*; besides, the different segments of these pieces, (some of which were segments of a greater, and others of a smaller arch) evince the same thing. The patient solemnly averred he voided above a hundred of these pieces: Some of these pieces were half as big as one's thumb, and a great many of them were of a smaller size; their external superficies was convex, and the internal of most of them concave; and some of them exhibited the *nucleus* of a *calculus*, as it is called. The number, and the very aspect of the

the bits of broken *calculi*, do farther confirm their having really come from the bladder, and their having been once whole ſtones therein, which afterwards were broken, and thrown out; but whether by the uſe of the medicines, or of the beer, or by the force of nature, the Dr. cannot determine. By the great convexity of the ſegments of the bits it may be judged, that hardly any of the *calculi* were bigger than a nutmeg, and that ſeveral of them were of a ſmaller ſize. Yet in the mean time they ſeem to him to evince, that the ſolution of ſtones in the bladder is not altogether impoſſible, tho' probably, it may be a thing that very rarely happens.

Concerning the Froſt *in* January 1730-1; *by Mr.* Derham. Phil. Tranſ. N° 417. p. 16.

IN *Phil. Tranſ.* N° 324, Mr. *Derham* gave an account of ſome of the moſt remarkable froſts, he could find any relation of; and particularly of that great, and he had almoſt ſaid univerſal one in 1708, which the *Royal Society* had very good hiſtories of from divers parts, and which he in that *Tranſaction* had taken from the original papers.

In that *Tranſaction* he has made it very probable, that the greateſt deſcent of the ſpirits in the thermometer was on *December* 30, 1708, when the ſpirit in his tube was within $\frac{1}{10}$ of an inch as low, as it is with artificial freezing with ſnow, or ice and ſalt: And in the froſt in *January* 1730-1 it was almoſt, if not altogether, as low.

The freezing-point of his thermometer is 10 inches (which he calls 100 degrees) above the ball; and the moſt intenſe freezing (according to the methods mentioned in that *Tranſaction*) is juſt at, or very little within the ball. And on *January* 30, about ſun-riſe, the thermometer was but an inch, or 10 degrees above the point of extreme freezing; and on *February* 3, only at $\frac{1}{2}$ an inch, or 5 degrees. And conſidering that the thermometer he obſerved with in 1708, was leſs accurate, and differently graduated from that which he had at this time, he is apt to think, that the froſt on *February* 3, was altogether as intenſe, as that on *December* 30, 1708: For, tho' a frigorific mixture ſunk the ſpirits but one tenth lower in the old thermometer, and about 5 or 6 tenths in that he obſerved with at this time; yet he takes the difference to be little, or none at all, on account of the tenderneſs of the new above the old glaſs.

And this degree of cold he takes to be as exceſſive, as in any of the years mentioned in the ſaid *Tranſaction*; nay, any of the

the years when the *Thames* at *London* was frozen over; and he is ſure, colder than in 1716, when that river was frozen over for ſeveral miles; and booths and ſtreets were made on the ice, an ox roaſted thereon, *&c.* For, the loweſt point of freezing in 1716 was on *January* 7, when the ſpirits fell to 35 degrees only, in the thermometer he made uſe of at this time: But the true cauſe of the freezing of the *Thames* that year was not barely the exceſs of the cold, but the long continuance of it; which was alſo the chief cauſe of thoſe remarkable congelations of that river in 1683 and 1708, when Mr. *Derham* ſaw coaches driven over the ice, large fires made on it, *&c.*

Several Experiments concerning Electricity; *by Mr.* Stephen Gray. Phil. Tranſ. N° 417. p. 18.

IN *February* 1728-9, Mr. *Gray* repeated ſome of the experiments he had formerly made, in the firſt diſcovery of an electrical attraction in ſeveral bodies, not before known to have that property; he made ſeveral attempts on the metals, in order to ſee, whether they might not be made to attract by the ſame method as other bodies were, *viz.* by heating, rubbing, and hammering; but without any ſucceſs: He then reſolved to procure a large flint-glaſs tube, to ſee if he could make any farther diſcovery with it, having recollected a ſuſpicion which he had had ſome years before, namely, that as the tube did, when rubbed in the dark, communicate a light to bodies, whether it might not at the ſame time communicate an electricity to them; tho' he never hitherto tried the experiment, not imagining the tube could have ſo conſiderable and ſurpriſing an influence, as to cauſe them to attract with ſo much force, or that the attraction would be carried to ſuch vaſt diſtances, as ſhall be found in the ſequel of this *Tranſaction.*

Before he proceeds to the experiments, he gives a deſcription of the tube: It is 3 foot 5 inches in length, and near 1. 2 inches in diameter: He gives the mean dimenſions; the tube being larger at each end than in the middle; the bore was about an inch: To each end he fitted a cork, in order to keep the duſt out, when the tube was not in uſe.

The firſt experiment he made was to ſee, whether he could find any difference in its attraction, when the tube was ſtopped at both ends with the corks, or when left open; but he could perceive no ſenſible difference: But upon holding a down-feather over againſt the upper end of the tube, he found, that it would go to the cork, being attracted and repell'd by it, as by the tube, when excited by rubbing. He then held the feather over againſt the flat end of the cork, which ſeveral times together attracted and repell'd; at which he was much ſurpris'd and concluded that there was certainly an attractive virtue communicated to the cork by the excited tube.

He fixed an ivory ball of about 1. 3 inches in diameter, with a hole thro' it, upon a fir-ſtick about 4 inches long, thruſting the other end into the cork; and upon rubbing the tube, found that the ball attracted and repell'd the feather with more vigour than the cork had done; repeating its attractions and repulſions for ſeveral times together: He then fix'd the ball upon longer ſticks; firſt upon one of 8 inches, and afterwards upon one of 24 inches long, and found the effect the ſame. Then he made uſe firſt of iron, and then of braſs-wire, to fix the ball on, inſerting the other end of the wire in the cork, as before; and he found that the attraction was the ſame, as when the fir ſticks were made uſe of; and that when the feather was held over againſt any part of the wire, it was attracted by it; but tho' it was then nearer the tube, yet its attraction was not ſo ſtrong as that of the ball. When the wire of 2 or 3 foot long was us'd, its vibrations caus'd by rubbing the tube, made it ſomewhat troubleſome to be managed: This put Mr. *Gray* upon thinking, whether if the ball were hung by a packthread, and ſuſpended by a loop on the tube, the electricity would not be carried down the line to the ball; he found it to ſucceed accordingly: For, upon ſuſpending the ball on the tube by a packthread about 3 foot long; when the tube had been excited by rubbing, the ivory ball attracted and repell'd the leaf-braſs, over which it was held, as freely as it had done, when it was ſuſpended on ſticks or wire; as did alſo a ball of cork, and another of lead, that weigh'd 1 pound and $\frac{1}{4}$.

After he had found that the ſeveral bodies above mentioned had an electricity communicated to them; he then went on to ſee upon what other bodies the tube would have the ſame effect, beginning with the metals, ſuſpending them on the tube by the method above-mentioned; firſt in ſmall pieces, as with a guinea, a ſhilling, a halfpenny, a piece of blocktin, and a piece of lead; then with larger quantities of metal, ſuſpending them on the tube with packthread. Here he made uſe of a fire-ſhovel, tongs, iron-poker, a copper-tea-kettle (which ſucceeded the ſame, whether empty, or full of cold or hot water) and a ſilver pint pot; all which were ſtrongly electrical, attracting the leaf-braſs to the height of ſeveral inches. After he had

found

found that the metals were thus electrical, he went on to make trials on other bodies, as flint-ſtone, ſand-ſtone, load-ſtone, bricks, tiles, chalk; and then on ſeveral vegetable ſubſtances, as well green as dry; and found that they had all of them an electric virtue communicated to them, either by being ſuſpended on the tube by a line, or fixed on the end of it by the method above-mentioned.

He next proceeded to try at what greater diſtances the electric virtue might be carried, and having by him part of a hollow walking cane (which he ſuppoſes was part of a fiſhing-rod) two foot ſeven inches long; he cut the great end of it, to fit it into the bore of the tube, into which it went about five inches; then when the cane was put into the end of the tube, and this laſt excited, the cane drew the leaf-braſs to the height of more than two inches, as did alſo the ivory ball, when fix'd to the cork and ſtick at the end of the cane. A ſolid cane had the ſame effect, when inſerted in the tube after the ſame manner as the hollow one had been. He then took the two upper joints of a large fiſhing-rod, the one of *Spaniſh* cane, the other partly wood, and the upper end whale-bone, which, together with the tube, made a length of more than 14 foot. Upon the leſſer end of the whale-bone was fix'd a ball of cork of about one inch and a quarter in diameter; then the large end of the rod being inſerted in the tube, the leaf-braſs laid on the table, and the tube excited, the ball attracted the leaf-braſs to the height of about three inches by eſtimation. With ſeveral pieces of *Spaniſh* cane and fir-ſticks he afterwards made a rod, which together with the tube, was ſomewhat more than 18 foot long, which was the greateſt length he could conveniently uſe in his chamber, and he found the attraction very nearly, if not altogether, as ſtrong, as when the ball was placed on ſhorter rods.

May 14, 1729, between 6 and 7 o'clock in the evening, having procur'd a rod of about 24 foot, that conſiſted of a fir-pole, of cane, and the top of reed, upon the end of which the ball of cork was placed, and the large end of the rod put into the tube about ſeven or eight inches; then the leaf-braſs being laid down, and the tube rubbed, the ball attracted and repell'd the leaf-braſs with vigour: So that it was not at all to be doubted, but with a longer pole the electricity would have been carried much farther.

May 16. he made a rod 32 foot long, including the tube; the larger part of it was a fir-ſtaff about ſix foot and a half long, the reſt was of cane, and reed for the top part thereof. All things being prepared as before, the effect was the ſame as in the laſt experiment; only the pole bending ſo much, and vibrating by rubbing the tube, made it more troubleſome to manage the experiment. This put him upon making the following experiments.

May 19, about ſix in the morning, the ivory ball being ſuſpended on the tube by a line of packthread 26 foot long (which was the height Mr. *Gray* ſtood at in a balcony, from the court where he ſtood that held the board with the leaf-braſs on it) and then the tube being rubbed, attracted the leaf-braſs to the height of near two inches, as he that aſſiſted informed him. This was repeated with the cork-ball with the ſame ſucceſs.

May 31, in the morning, a line of 34 foot in length was tied to a pole of 18 foot: So that the pole and line together were 52 foot. With the pole and tube Mr. *Gray* ſtood in the balcony, the aſſiſtant below in the court, where he held the board with the leaf-braſs on it; then the tube being excited as uſual, the electric virtue paſſed from the tube up the pole, and down the line to the ivory-ball, which attracted the leaf-braſs; and as the ball paſſed over it in its vibrations, the leaf-braſs would follow it, till it were carried off the board: But theſe experiments are difficult to make in the open air, the leaſt wind that is ſtirring carrying away the leaf-braſs.

Some time after he made ſeveral attempts to carry the electric virtue in a line horizontally; ſince he had not the opportunity here, of carrying it from greater heights perpendicularly, but without ſucceſs, for want of then making uſe of proper materials, as will appear from what follows. The firſt method he made trial of was by making a loop at each end of a line, and hanging it on a nail, driven into a beam, the other end hanging downwards; thro' the loop at this end the line with the ivory-ball was put, the other end of this line was by a loop hung on the tube: So that the part of the line next the ball hung perpendicular, and the reſt of the line horizontal: Then the leaf-braſs being laid under the ball, and the tube rubbed, there was not the leaſt ſign of attraction perceiv'd. Upon this he concluded, that when the electric virtue came to the loop, that was ſuſpended on the beam,

beam, it went up the ſame to the beam: So that none, or very little of it at leaſt, came down to the ball; which was afterwards verified, as will appear by the experiments that ſhall be mentioned hereafter.

June 30. 1729, Mr. *Gray* went to *Otterden-place*, to give Mr. *Wheler* a ſpecimen of his experiments: The firſt was from the window in the long gallery, that opened into the hall, the height being about 16 foot; the next experiment was from the battlements of the houſe down into the fore-court, 29 foot; then from the clock-turret to the ground, which was 34 foot; this being the greateſt height we could come at; and notwithſtanding the ſmallneſs of the cane, the leaf braſs was attracted and repell'd beyond what Mr. *Gray* expected. As we had no greater heights here, Mr. *Wheler* was deſirous to try whether we could not carry the electric virtue horizontally: Mr. *Gray* then told him of the attempt he had made with that deſign, but without ſucceſs; as alſo of the method and materials made uſe of, as mentioned above. Mr. *Wheler* then propos'd a ſilk line to ſupport the line, by which the electric virtue was to paſs. This Mr. *Gray* told him might do better on account of its ſmallneſs: So that there would be leſs virtue carried from the line of communication; with which, together with the apt method Mr. *Wheler* contriv'd, and with the great pains he took, and the aſſiſtance of his ſervants, we ſucceeded far beyond our expectation.

The firſt experiment was made in the matted gallery *July* 2. 1729, about 10 o'clock in the morning. About four foot from the end of the gallery there was a croſs-line, fixt by its ends to each ſide of the gallery by two nails; the middle part of the line was ſilk, the reſt at each end pack-thread, then the line to which the ivory ball was hung, and by which the electric virtue was to be convey'd to it from the tube, being 80 foot and a half in length, was laid on the croſs ſilk line; ſo that the ball hung about nine foot below it. Then the other end of the line was by a loop ſuſpended on the glaſs cane, and the leaf-braſs held under the ball on a piece of white paper; when the tube being rubbed, the ball attracted the leaf-braſs, and kept it ſuſpended for ſome time.

This experiment ſucceeding, and the gallery not permitting to go any farther in one length, Mr. *Wheler* thought of another expedient, by which we might increaſe the length of our line; which was by putting up another croſs line near the

the other end of the gallery; and over the silk part of both the lines there was laid a line, that was long enough to be returned to the other end, where the ball hung; and tho' now both ends of the line were at the same end of the gallery; yet care was taken that the tube was far enough off from having any influence upon the leaf-brass, except what passed by the line of communication: Then the cane being rubbed, and the leaf-brass held under the ivory ball, the electric virtue passed by the line of communication to the other end of the gallery, and returned back again to the ivory ball, which attracted the leaf-brass, and kept it suspended as before. The whole length of the line was 147 foot.

We then thought of trying, whether the attraction would not be stronger, without doubling or returning the line, which we found means of doing in Mr. *Wheler*'s barn, where we had a line of 124 foot long, 14 foot of which hung perpendicular from the silk line; and now the attraction was, as we then concluded, stronger than when the line was return'd, as in the matted gallery.

July 3, between 10 and 11 o'clock in the morning we went again into the barn, and repeated the last mentioned experiment, both with the tube and cane; but the attraction was not so strong, as the preceeding evening, nor was there so great a difference in the attraction, communicated by the solid cane and glass tube, as one would have expected, considering the difference of their lengths and diameters.

We then proceeded farther, by adding so much more line, as would make a return to the other end of the barn, the whole length of the line being now 293 foot; and tho' the line was so much lengthened, we found no perceivable difference in the attraction, the ball attracting as strongly as before. This encouraged us to add another return; but upon beginning to rub the tube, our silk lines broke, not being strong enough to bear the weight of the line, when shaken by the motion communicated to it by rubbing the tube. Upon this, instead of the silk we put up small iron wire; but this was too weak to bear the weight of the line: We then took brass wire of a somewhat larger size than the iron wire. This supported our line of communication. But tho' the tube was well rubbed, yet there was not the least motion or attraction, communicated by the ball, neither with the great tube which we made use of, when we found the small solid cane to be ineffectual. By which we were now convinced, that the

success

ſucceſs we had before depended upon the lines that ſupported the line of communication, being ſilk; and not upon their being ſmall, as before trial Mr. *Gray* imagined it might be; the ſame effect happening here as it did, when the line that is to convey the electric virtue is ſupported by packthread, *viz.* that when the effluvia come to the wire, or packthread that ſupports the line, it paſſes by them to the timber, to which each end of them is fixt; and ſo goes no farther forward in the line that is to convey it to the ivory ball.

Finding that our ſilk threads were too weak to bear many returns of line, Mr. *Wheler* thought of another way of managing them: ſo that fewer returns might be upon each ſilk line; which was by placing two other croſs lines ſome feet below the upper ones: So that every other turn of line was ſuſpended by the lower croſs line. By this means there was but half the weight of line upon each ſilk of what there was, when only two croſs lines were made uſe of as before. By this contrivance we could add a much greater length of line without danger of breaking our ſilk. We then put up a line, that was 666 foot in length, by eight returns: Then the leaf-braſs being held on a piece of white paper under the ivory ball; and the tube, with the other end of the line ſuſpended thereon, being rubbed for ſome time, the leaf-braſs was attracted as manifeſtly, as it had been with much ſhorter lines. We then repeated the experiment with the little ſhort ſolid cane, and found there was ſomewhat of an attraction, but not near ſo great as with the large tube.

Tho' the going and returning of the electric effluvia was very ſurpriſing, yet we were willing to try, how far the attractive virtue might be carried in a continued right line; the method of doing which was as follows: That end of the line where the attraction was to be made, was ſuſpended on a ſilk line, that was fixed croſs the garret-window on the north ſide of the houſe, which was by eſtimation about 40 foot high: At about 100 foot from hence two rods or poles of about ten foot in length, and at two foot diſtance from each other, were driven into the ground in ſuch a manner as that they ſtood nearly perpendicular. Theſe were in the large garden, beyond theſe in the large field, that is ſeparated from the garden by a deep foſs; about the ſame diſtance from the firſt were fixed another pair of poles; then four others at a like diſtance: Upon the ends of theſe poles were tied the

croſs

crofs lines of filk, in order to fupport the line of communication; which being laid on the filk lines, the ivory ball hanging in the garret window; and the other end of the line being hung by a loop on the tube, the leaf-brafs was held under the ball; and after the tube had been rubbed for fome time, they call'd to Mr. *Gray* to let him know, that there was an attraction of the leaf-brafs: This was feveral times repeated with fuccefs. Then Mr. *Wheler* came into the field, and rubbed the tube himfelf, that Mr. *Gray* might fee there was an attraction; which he did, tho' he perceived it not to be fo ftrong, as when the attraction was convey'd by a longer line by returning it, as in the experiments above-mentioned. The length of the line was 650 feet. This was feveral times repeated; but the experiment being made in the evening, at length the dew began to fall. We began about 7 o'clock, or fome little time after; but before 8 o'clock the attraction ceas'd: But whether this was caus'd by the dew falling, or by Mr. *Gray*'s being very hot, we could not pofitively fay. This experiment was made *July* 14, 1729.

N. B. That tho' we call the carrying the electric virtue by the lines in this pofition horizontal, you are not to underftand in a ftrict fenfe, as may be eafily perceiv'd by the defcription of the method; and that as the line fwagged down much below the filk lines that fupported it, in the middle part between thofe lines it was fome feet longer than the diftance of the poles.

Some days after this experiment was repeated from the turret clofet window, when the line was 765 feet; and the attraction was no lefs perceivable than in the experiment above-mentioned.

The following experiments, made at Mr. *Wheler's*, fhew that large furfaces may be impregnated with electric effluvia.

A large map of the world, containing 27 fquare feet, as alfo a table cloth, containing 59 fquare feet, being fufpended on the tube by packthreads, became electrcal: An umbrello, fufpended by a packthread, tied to the handle thereof, became ftrongly electrical.

An experiment to fee whether the electric virtue would be any way hindered by the magnetical effluvia of a loadftone.

The loadftone had a fmall key fufpended by one of its arming irons, and both of them were fufpended on the tube by by a packthread, then the tube being rubbed; both the key and ſtone attracted the leaf-braſs; the attraction being the ſame as that of other bodies.

An experiment made to ſhew that the electric virtue is carried ſeveral ways at the ſame time, and may be convey'd to conſiderable diſtances.

There were made three ſtands, each compoſed of two upright pieces of fir, fixt perpendicular, near the ends of a long ſquare board, near a foot and a half diſtant from one another. Upon the tops of theſe were tied threads of ſilk to ſupport the lines of communication with the tube and attracting bodies. One of theſe ſtands was placed in Mr. *Wheler*'s great parlour, near the farther end; another in the little parlour; and a third in the hall, which was between the two parlours: As the other two were one of them to the right, and the other to the left hand, this laſt was placed near the hall-window forwards: The two firſt were about 50 feet; the other about 20 feet from the place where the tube was held: Then there were taken three ſmall ſquare pieces of wood, that were tied to three lines of packthread; theſe were about the lengths above-mentioned: They were laid on the ſilk lines; and by loops at the other ends were ſuſpended on the tube: Then the leaf-braſs being held under the pieces of wood, and the tube rubbed, they all of them attracted the leaf-braſs at the ſame time: And ſome time after in Mr. *Gray*'s abſence, Mr. *Wheler* tried a red hot poker; and found that the attraction was the ſame, as when cold. He alſo ſuſpended a live chick upon the tube, by the legs, and found that the breaſt of the chick was ſtrongly electrical.

At Mr. *Godfrey*'s Mr. *Gray* made the following experiments, ſhewing that the electric virtue may be carried from the tube, without touching the line of communication, by only being held near it.

The firſt of theſe experiments was made *Auguſt* 5, 1729. He took a piece of hair cloth, ſuch as linen-cloaths are dried on, of about 11 foot in length; which, by a loop at the upper end of it was ſuſpended on a nail, that was driven into one of the rafters in the garret, and had at its lower end a weight of 14 pounds, hung to it by an iron ring: Then the leaf-braſs was laid under the weight, and the tube rubbed, and being held near the line without touching it, the lead-weight attracted and repell'd the leaf-braſs for ſeveral times together, to the height of at leaſt three, if not four inches. If the tube were held three or four feet above the weight, there would be an attraction; but if it were held higher up; ſo as to be near the rafter, where the weight was ſuſpended by the hair-line, there would be no attraction.

An experiment ſhewing that the electric virtue may be carried ſeveral ways at the ſame time, by a line of communication, without touching the ſaid line.

There were taken two hair-lines, between four and five feet long; to each of theſe was tied a ſquare piece of cork, by packthread; the lines were ſuſpended by loops at their upper ends upon two nails; near the lower ends there was tied to the hair-lines a piece of packthread, by which there was a communication between the two hair-lines; then the leaf-braſs being laid under the corks, and the tube rubbed, and held near one of the lines, both the corks attracted: But that which was fartheſt much ſtronger than that near which the tube was held. About the middle of the line of communication they both attracted with equal force.

Some time after, at Mr. *Wheler's*, we made the following experiment, in order to try whether the electric attraction be proportional to the quantity of matter in bodies.

There were made two cubes of oak, about ſix inches ſquare, the one ſolid, the other hollow: Theſe were ſuſpended by two hair-lines, nearly after the ſame manner, as in the experiment above-mentioned: The diſtance of the cubes from each other was, by eſtimation, about 14 or 15 feet; the line of communication being tied to each hair-line, and the leaf-braſs placed under the cubes, the tube was rubbed and held over the middle of the line, and as near as could be gueſs'd, at equal diſtances from the cubes; when both of them attracted and repell'd the leaf-braſs at the ſame time, and to the ſame height: So that there ſeemed to be no more attraction in the ſolid, than in the hollow cube; yet Mr. *Gray* is apt to think, that the electric effluvia paſs thro' all the interior parts of the ſolid cube, tho' no part but the ſurface attracts: For, from ſeveral experiments it appears, that if any other body touch that which attracts, its attraction ceaſes till the body be remov'd, and the other be again excited by the tube.

The ſequel of the experiments made at Mr. *Godfrey's*.

Mr. *Gray* next went on with an experiment to ſee if the electric virtue might not be convey'd to a rod, without inſerting it into the bore of the tube, or without touching the rod, which

the

he found to ſucceed, by ſuſpending the rod either by lines of ſilk, or by pieces of horſe-hair fiſhing lines, placing a ball of cork on the leſſer end of the rod.

Auguſt 13, 1729. he took a large pole, that was 27 feet long, two inches and a half in diameter at the great end, and about half an inch at the leſſer end: It was that ſort of wood they call horſe-beech, with the rind on. This was ſuſpended by two hair-lines of about four foot and a half in length; the firſt line was about two foot from the great end of the pole; the other about eighr foot from the leſſer end: So that the pole hung horizontal. At the ſmall end of the pole was ſuſpended a ball of cork about an inch and a half in diameter, by a packthread about a foot long, and a ſmall leaden ball upon the cork to keep the packthread extended: Then the leaf-braſs being laid under the cork, the tube rubbed, and held near the great end of the pole, the cork-ball attracted the leaf-braſs ſtrongly to the height of an inch, if not more: Then the leaf-braſs being held under ſeveral parts of the pole, it was attracted thereby, as Mr. *Godfrey* obſerv'd, but not near ſo ſtrongly as by the cork.

About the beginning of *September* 1729, Mr. *Gray* made the following experiment, which ſhews that the electric effluvia will be carried in a circle, and communicated from one circle to another.

There was taken a hoop of about two foot, two inches in diameter; this he ſuſpended by a hair-line upon a nail, driven into a beam; the line was about four foot long; then the leaf-braſs being laid under the hoop, the tube was rubbed, and held within the hoop, near its upper ſide, without touching it, by ſeveral inches: Then the lower part of the hoop attracted and repell'd the leaf-braſs ſtrongly; but when held near the lower part, there was very little, if any, attraction. If the tube were held near the outſide of the hoop, it attracted; but ſtrongeſt, when at the ſame time it was held near the knot of the hair-line, by which the hoop was ſuſpended. To this hoop there was tied a leſſer hoop of about a foot and a half in diameter: It was tied to it by packthread; ſo as to hang below it about two inches. They were ſuſpended together by the hair-line; then the leaf-braſs and tube being prepared, as mentioned before, the tube being held near the upper hoop, the lower part of the lower hoop attracted ſtrongly; and when held near the upper part of the lower hoop, but very weakly: But when held near the lower part of the lower hoop, there was no attraction.

September 5, Mr. *Gray* made the following experiment, which shews that the electric effluvia have the same effect in a circle, when its position is horizontal.

He took a large hoop, of somewhat more than 3 foot diameter, and about 2 inches and a half in breadth; to this were tied, at near equal distances, 4 lines of twine (*i. e.* three threads of packthread twisted together) each about 2 feet 8 inches long. These were tied with their ends together to a hair-line of about 2 foot and a half long, by which the hoop was suspended on a nail, as in the other experiments; so that the hoop hung now in a horizontal position: Then the brass-leaf being laid under the edge of the hoop, at between 2 and 3 inches below it, the tube being rubbed, and held between the cords without touching them, the leaf-brass was attracted and repell'd for several times together; but when held near the outside of the hoop, opposite to that part where the leaf-brass lay, the attraction was much stronger.

About the latter end of autumn 1729, he resumed his enquiry after other electric bodies, and found many more that have the same property, and may be excited to attract by the same method: As for instance, the dry wither'd leaves of reeds and flags, grass and corn, both leaves and straw; the leaves of trees, as those of the laurel, oak, walnut, chesnut, hazle nut, apple and pear-tree leaves: So that we may conclude, that the leaves of all vegetables have this attractive virtue.

Mr. *Gray* made the following experiments at his chamber *March* 23, 1730. he dissolved soap in the *Thames* water; then he suspended a tobacco-pipe by a hair-line; so as that it hung nearly horizontal, with the mouth of the bowl downwards; then having dipped it in the soap-liquor, and blown a bubble, the leaf brass being laid on a stand under it, and the tube rubbed, the brass was attracted by the bubble, when the tube was held near the hair-line. Then he repeated the experiment with another bubble, holding the tube near the small end of the pipe; and the attraction was now much greater, the leaf-brass being attracted to the height of near two inches.

March 25, he repeated this experiment after a somewhat different manner: The pipe was now suspended by two lines of white sewing silk, of about 5 foot and ½ long; these were hung upon 2 nails, driven into the beam of his chamber, about

a foot

a foot diſtant from each other, by loops at the other ends of the lines, by which the pipe was ſuſpended; then the bubble being blown, by holding the tube to the ſmall end of the pipe, the bubble attracted the leaf-braſs to the height of near 4 inches. This experiment was made in order to ſee whether fluid bodies would not have an electricity communicated to them.

April 8. Mr. *Gray* made the following experiment on a boy between 8 and 9 years of age: His weight with his cloaths on was 47 pounds 10 ounces. He ſuſpended him in a horizontal poſition, by 2 hair-lines, ſuch as cloaths are dried on: They were about 13 foot long, with loops at each end. There was driven into the beam of his chamber, that was a foot thick, a pair of hooks oppoſite to each other; and 2 foot from theſe another pair in the ſame manner.

Upon theſe hooks the lines were ſuſpended by their loops; ſo as to be in the manner of two ſwings, the lower parts hanging within, about 2 feet from the floor of the room: Then the boy was laid on theſe lines with his face downwards; one of the lines being put under his breaſt; the other under his thighs: Then the leaf-braſs was laid on a ſtand, which was a round board of a foot diameter, with white paper paſted on it, ſupported on a pedeſtal a foot high, which Mr. *Gray* had frequently made uſe of in his experiments: Upon the tube's being rubbed, and held near his feet, without touching them, the leaf-braſs was very vigorouſly attracted by the boy's face; ſo as to riſe to the height of 8, and ſometimes 10 inches. Mr. *Gray* put a great many pieces of leaf-braſs on the board together, and almoſt all of them roſe up together at the ſame time. Then the boy was laid with his face upwards; and the hinder part of his head, which had ſhort hair on, attracted, but not at quite ſo great a height as his face did. Then the leaf-braſs was placed under the boy's feet (his ſhoes and ſtockings being on) and the tube held near his head, his feet attracted, but not altogether at ſo great a height, as his head; then leaf-braſs was again laid under his head, and the tube over it; but there was then no attraction; nor was there any, when the leaf-braſs was laid under his feet; and the tube held over them.

April 16, Mr. *Gray* repeated the experiment with the boy; but now the attraction was not quite ſo ſtrong, as at the firſt, the leaf-braſs not riſing higher than to about 6 inches. The boy's hands being extended nearly horizontal, Mr. *Gray* placed a ſmall ſtand with leaf-braſs under each hand, and the large

ſtand

ſtand, furniſhed as the others, under his face; when the excited tube being held near his feet, there was an attraction by his hands and face at the ſame time. Mr. *Gray* then gave him the top of a fiſhing rod to hold in his hand; there was a ball of cork ſtuck on its ſmall end, under which the leaf-braſs being laid, and the tube rubbed and held near his feet, the ball attracted the leaf-braſs to the height of 2 inches; and very vigorouſly repell'd and attracted it for ſeveral times together.

April 21, Mr. *Gray* repeated the experiment on the boy; and now he attracted much ſtronger than at the firſt: The leaf-braſs roſe to his face at the height of more than 12 inches: Then he gave the boy to hold in each hand the tops of 2 fiſhing rods, with a ball of cork on each of their ſmall ends; then a ſmall ſtand being ſet under each ball, with the leaf-braſs on it, the tube being rubbed and held near his feet, both the corks attracted and repell'd together ſtrongly. The length of each of the poles was about 7 foot. Then the boy was laid on his left ſide, and a fiſhing rod, of near 12 feet in length, given him to hold with both his hands; there was a ſmall ball of cork at the end of the rod, that was an inch and three quarters in diameter: Then every thing being prepared, the tube held near the boy's feet, the cork ball attracted and repelled the leaf-braſs forcibly to the height of at leaſt 2 inches.

N. B. That when Mr. *Gray* ſpeaks of holding the tube near the boy's feet, he means over againſt the ſoles of his feet; and when near his head, he means the crown of his head: For, when the tube is held above, or over his legs, the attraction is not ſo ſtrongly communicated to the other parts of his body.

By theſe experiments we ſee that animals receive a greater quantity of electric effluvia; and that they may be convey'd from them ſeveral ways at the ſame time to conſiderable diſtances, wherever they meet with a paſſage proper for their conveyance, and there exert their attracting power.

In theſe experiments, beſides the large ſtand abovemention'd, Mr. *Gray* made uſe of two ſmall ones, the deſcription of which is as follows; the tops of them were 3 inches diameter; they were ſupported by a column of about a foot in height; their baſes of about 4 inches and ½; they were turned of *lignum vitæ*; their tops and baſes made to ſcrew on for conveniency of carriage; upon the tops was paſted white paper: When the leaf-braſs is laid on any of theſe ſtands, he finds it is attracted to a much greater height than when laid on a table; and at leaſt 3 times higher than when laid on the floor of a room.

June

June 20, 1730, Mr. *Gray* made the following experiment, ſhewing that the attraction and repulſion is as ſtrong, if not ſtronger; and that the effluvia may be carried to conſiderable lengths, without touching the line by the tube.

There was taken a line of packthread 231 foot in length; it was ſupported on 2 croſs lines of blue ſilk, whoſe diſtance was near 18 foot: About 4 foot below one of theſe lines was put up another ſilk line of the ſame colour; to this was tied one end of the packthread; at the other end the ivory ball hung; the line was returned over the croſs lines 13 times: Then the leaf-braſs being laid under the ball, upon one of the ſmall ſtands, and the tube excited, the ball attracted and repell'd to the height of one of its diameters, which was about an inch and a quarter.

Mr. *Gray* found by ſeveral trials, that rubbing the tube, and putting it up between the returns of the line in ſeveral places, before he went with the tube to the end of the line, much facilitates and cauſes the attraction much ſooner than when one ſtands with the tube, and applies it to the end of the line only.

Auguſt 1. 1730, at Mr. *Wheler's* was made the following experiment, being an attempt to ſee how far the electric virtue might be carried forward in a line, without touching the ſame.

This experiment was made by carrying the line out of the great parlour room into the garden, and down the great field before it. The line was ſupported by 15 pair of poles; each pair had a line of blue ſilk, tied from one pole to the other, the length about 4 feet, equal to the diſtance of the 2 poles: About 10 feet from the window there was a ſilk line put up croſs the room, upon which that part of the line hung that had the ivory ball upon it. Below the croſs line of the fartheſt pair of poles was placed another croſs line, four feet from the ground, to which was faſtened the other end of the communicating line, as mentioned in the experiment above: Then the leaf-braſs and tube being prepared as uſual; the tube being held over the line at ſeveral diſtances, beginning towards that end where the ball hung; and ſo proceeding towards the farther end of the line, the leaf-braſs was attracted pretty ſtrongly at the ſtations, not exceeding 2 or 300 feet; but ſtill grew weaker, as we came towards the farther end of the line: Yet even at the end of the line, the leaf-braſs would be lifted by the ball, when the tube touch'd the line, whoſe length was 886 feet.

Colour'd bodies, as Mr. *Gray* diſcovered in 1729, attract more or leſs, according to what colours they are of, tho' the ſub-

ſubſtance be the ſame, and of equal weight and bigneſs; only that the red, orange, or yellow, attract at leaſt 3 or 4 times ſtronger than green, blue, or purple: But he lately found out a new and more accurate method of making theſe experiments.

A remarkable plica Polonica; *by Dr.* Abraham Vater; *together with an Account of the Cauſe thereof; by Dr.* Sprengel. Phil. Tranſ. N° 417. p. 50. *Tranſlated from the* Latin.

A Country woman living in the lands of Prince *Radzivil* in *Poland*, being married in the 15th year of her age, was in her 18th ſeized with the epidemical diſtemper of that country, which, from the plaitting of the hair, is call'd the *Plica Polonica*: She labour'd under it for 50 years together, and for almoſt all that time ſhe was confined to her bed by arthritic pains, and ſpaſms, which at length ended in an univerſal *maraſmus* of her body; till ſpent with age, ſhe died in her 78th year. Dr. *Flouricke*, phyſician to Prince *Radzivil*, did not only ſee this woman in her life time, and cauſe delineate her to the life, as repreſented Fig. 4. Plate VI. but likewiſe cut the *plica* off after her death and brought it to *Wittemberg*. It was 4 ells long, a palm broad, and 2 inches thick; but it would have been much longer, as Dr. *Flouricke* affirms, had not a great part of it been conſumed by naſtineſs, rubbing, and the length of time the patient kept her bed.

The *plica* has been always thought to be a diſtemper, and to proceed from a fever or convulſions; but for Dr. *Sprengel*'s part, from the beſt information he could procure concerning it, he takes it to be owing to naſtineſs, from not combing the hair, nor waſhing the head: For, if it were a real diſtemper, the people of faſhion could no more be free from it than the common people, among whom it only happens. This is confirmed by the following article in the *Acta Breſlavienſia*, entituled Sammlung von Natur, &c. for the month of *Auguſt* 1724, *art.* 17. p. 126.

'The great number of people in *Poland*, who are troubled 'with this *plica*, firſt made me reflect, whether it were a real 'diſtemper or no? But I am now convinced, that their ſwiniſh 'way of living, and the common opinion ſo deeply rooted in 'the generality of the people, namely, that this lock of hair 'cannot be taken off without danger of their lives, have contri'buted more to this complaint than any real indiſpoſition of 'body; conſidering that it is the middling or poorer ſort of

people,

'people, who are troubled with it, whom one cannot ſee with-'out horror: But no *German*, of whom great numbers live in 'that country, ever had any ſuch thing grow. Several of them, 'who are married to *Poliſh* women, are ſcarce able to perſuade 'their wives not to train up their children to this naſtineſs. Not 'long ſince I ſaw a fellow at church, who had about 70 of ſuch 'locks, hanging down, twiſted hard like ſo many penny-cords: 'So that one might eaſily have taken his for a *Meduſa*'s head; 'and it is probable, that, in ancient times, ſome ſuch locks as 'theſe might have given riſe to the poetical fiction of ſnakes 'growing on the head, inſtead of hair? Be that as it will, it is 'certain, that it is a moſt odious ſight.'

An unuſual agitation in the Magnetic Needle, *obſerv'd to laſt for ſome time, in a Voyage from* Maryland; *by* Captain Walter Hoxton. Phil. Tranſ. N° 417. p. 53.

ON the 2d of *September*, 1724, a little after noon, being in latitude 41° 10′ N. and about 28° E. difference of longitude from *Cape Henry* in *Virginia*, the weather fair, a moderate gale and ſmooth ſea, Capt. *Hoxton*'s mate, who was on deck, came and told him, that the compaſs traverſed ſo much that he could not poſſibly ſteer by it: Upon which the Captain went up, and after trying it in ſeveral parts of the ſhip, found what the mate ſaid to be true. The Captain then had all his compaſſes brought up, and placed in different parts of the ſhip, and in places moſt remote from iron; and to his great ſurpriſe found them all in the ſame condition: So that they could not ſteer by any of them.

He then new touch'd ſome of them with a loadſtone; and leſt that ſhould affect them, ſent it out to the end of the bow-ſprit; but he did not perceive that the new touching was of any ſervice: For, they all continued traverſing very ſwiftly, for about an hour after the Captain came upon deck; and then on a ſudden every one of them ſtood as well as uſual. During the whole time the ſhip had very little motion; and there was an azimuth compaſs, and 4 or 5 others on board.

An Aurora Borealis *obſerved in* New England, October 22, 1730; *by Mr.* Iſaac Greenwood. Phil. Tranſ. N° 418. p. 55.

THE *aurora borealis* has of late been very frequent with us in *New England*; but none ſo conſiderable, either for brightneſs, variety, or duration, as what happened *Thurſ-*

day night, the 22d of *October*, 1730. This meteor has been obſerved in *New England*, at different times, ever ſince its firſt plantation; but Mr. *Greenwood* thinks at much longer intervals than of late years, and never to ſo great a degree as the preſent inſtance: Nor indeed is there any recorded in the *Philoſophical Tranſactions*, that he could think, by their deſcription, equal to it; excepting only that remarkable one of the 6th of *March* 1716, obſerved by the moſt judicious and learned Dr. *Halley*; and in ſeveral reſpects even that muſt give the preference to it. And on this account Mr. *Greenwood* thought the moſt particular account of this meteor would not be unacceptable to the *Royal Society*; and therefore he ſent them all his notes (which are very numerous) relating thereto, almoſt to every change and circumſtance of the appearance. He is perſuaded there is no better way to arrive at the true cauſe of this extraordinary phenomenon, than by attending to the minuteſt particulars and circumſtances thereof.

Oct. 22. 1730, $6^h\ 30'$ P. M. there lay near the horizon an extraordinary duſkiſh vapour, (as repreſented in Fig. 5. Plate VI.) reaching from N. W. b. N. to N. E. b. E. The upper edge was the ſegment of a circle, whoſe greateſt height from the horizon was about 15°, bearing nearly N. b. E. adjoining to this was a concentric ſegment of a very bright azure colour, of a greeniſh caſt, ſtrongly illuminated, a few degrees in breadth; and then dilated more and more, till it became blended with an extenſive brightneſs or *aurora*, which lay every where above it for about 45 degrees.

There was in ſeveral places a faint caſt of red. The heavens were every where elſe perfectly ſerene; a ſmall weſterly wind, and the moon upwards of 80° below the eaſtern horizon.

At $6^h\ 35'$, two *ſtriæ* riſing perpendicularly from different parts of the illuminated edge of the vapour (which he all along ſuppoſes to continue its figure, when there is no particular intimation to the contrary) were of a faint red colour, and reach'd to the height of 45° at leaſt.

At $6^h\ 40'$ the *ſtriæ* were very numerous to the left, each riſing about 45°; and one in the middle (by which he always means the middle of the northern duſky vapour) roſe to a ſurpriſing height. It was 8 or 10° in breadth, of a light azure, tinged with green; and in ſeveral places ſtreaked vertically with a bright flame colour. There was alſo N. W. b. N. a large area or body of a very intenſe red.

At

At 6^h 45′ the whole (as in Fig. 6.) was exceeding luminous. The red was diffus'd in all parts above the greeniſh light, which now bounded the duſkiſh vapour in the north; and indeed ſeveral parts of this were likewiſe tinged with it. But the moſt intenſe red was towards the N. W. and N. E. b. E. between which were various pyramidal ſtreams of different colours; ſome blue, ſome green, other flame-colour'd, &c. ſeveral tinged with, and all terminated by, the diffuſive roſineſs. One *ſtria* was of a ſurpriſing luſtre, of a light azure turned upon green, appearing N. W. b. N. This ſcene was very beautiful, the height of each column about 45°, and ſeveral of them well defined.

At 6^h 50′ the enlighten'd part of the hemiſphere was every where tinged with red; its horizontal bounds the ſame as before; but its altitude was about 70°. Whence it appears the *aurora* is conſiderably extended upwards. The reddiſh caſt on the right hand from north to eaſt was beautifully diſtinguiſhed into perpendicular *ſtriæ*, which generally obſerved the following order of colours, beginning from the eaſt; *viz.* a deep azure, which ſucceſſively proceeded to the lighteſt blues (tho' each column was of ſuch intenſity, as to be diſtinguiſhed from the neighbouring columns) after which follow'd ſeveral degrees of green, and then of red, the deepeſt being an intenſe ſcarlet. And this order was repeated ſeveral times, filling up the whole ſpace from N. E. to N. b. W. The weſtern regions were at the ſame time of an undiſtinguiſhed red. Several of the riſing columns were very exactly terminated.

At 6^h 55′ the red (Fig. 7.) which in the laſt lay towards the zenith, became very intenſe; darting to the horizontal vapour, throughout the intermediate ſpace, innumerable *ſtriæ* differently colour'd. The horizontal duſkiſh cloud was ſomewhat rais'd, with an apparent *ſtratum* of blue juſt under it, which was of a fainter caſt towards the horizon, as the colour of the ſky is when over charged with vapours. The upper ſurface of red jutted out irregularly, in ſeveral places, tho' in general well terminated; as Mr. *Greenwood* has obſerved the caſe to be in ſome riſing clouds.

At 7^h the diſtinguiſhed red towards the zenith approached nearer to it; it was about 20° broad upon the meridian; and thence tapering to the eaſtern and weſtern horizon. The whole appearance was of a reddiſh hue, and in ſome places faintly ſtreaked. At this time appear'd E. S. E. conſiderably remov'd from the other phenomena, a remarkable oval, the tranſverſe diameter erect, about 30° in length, and of a very bright azure. The whole scene was very beautiful.

At 7h 2′ and ½ the phenomena were much the same, only that the reddish cast had risen, and was now (Fig. 8.) diffus'd to the southward of the zenith. The other parts of the northern hemisphere were much like the genuine *aurora*, interspers'd with various small clouds. There were two distinguished parallelogramic *areæ* of an intense red, nearly 30° in diameter; the one to E. b. N. the other to N. W. which was of the deepest colour, and cross'd in the middle with a black bar. The bright azure still remained towards the E. S. E.

At 7h 5′ the whole appearance seemingly vanish'd, only that the northern regions retained the *aurora*, which was as bright as about ½ an hour after sun-set. The eastern area of red was distinguishable, tho' very faint, reaching from 30° to 50° high; and in like manner the former area to the N. W. was somewhat more intense. This was the same as in the preceeding observation; and the black bar, mention'd then, appear'd now to be a cloud moving eastward, part of which was observed on this red area, and part to the north. And in this view the red vapour appear'd vastly more distant than the cloud. There were several small spaces of light interspersed throughout the scene.

At 7h 15′ the appearance somewhat changed. The area of red N. W. was the most intense. Several rising columns of a faint red and blue between W. and N. a deep red E. b. N. Mr. *Greenwood* all along observed, that some of the fixed stars could be seen thro' all the colours that were successively laid upon them, tho' with considerable differences as to obscurity and clearness, according to the intensity of the colours. There were no clouds in the southern regions.

At 7h 20′ the wind was all along W. and W. b. N; and if the strongest winds be expressed by 10, this was sometimes 2, and he thinks never less than unity. He was informed that at *Boston*, which lies about 3 miles eastward, it was all the while to the eastward of the south. The *aurora* still continued of the same dimensions; but the edge of the duskish horizontal cloud abated much of its brightness and colour. There were 4 remarkable spots or area's of red; one E. b. N. one N. E. b. N. very intense, as also another nearly north; and the last bore N. W. b. N, which with the E. b. N. was of some considerable duration. There were several considerable *striæ* intermixed with red, and a flame-colour rising about N. N. W.

At

At 7h 28′ the redneſs about the north increas'd very much in its dimenſions and intenſity. It reach'd from the north ſtar to about 20° upwards, and was exceeding bright for about 12°. It was diſtinguiſhed into ſeveral perpendicular columns of various degrees of red, and ſeveral well defined.

At 7h 30′ the redneſs N. E. b. N. mov'd weſtward, and was conſiderably alter'd in that reſpect ſince the firſt obſervation thereof. That about the north ſtar was now divided in the middle by a perpendicular column very broad, and of a very intenſe yellow light. It appear'd now that this alſo had a ſlow motion weſtward: But the weſtern redneſs had all along advanced eaſtward at a conſiderable rate.

At 7h 37′ the 3 red area's, juſt mentioned, are (Fig. 9.) now united, and nearly confounded with one another. The diſtinction was only as to the degree of redneſs. The *aurora*, which lay partly under theſe, conſiderably abated of its luſtre; and the horizontal bounds contracted to about 80°, tho' the altitude was rather increas'd. The eaſtern and weſtern limits ſeemed ſtill to approach each other very ſlowly. There was one *ſtria* very conſiderable, horizontally poſited, and about 5° broad, of a bright flame-colour, reaching from the horizontal bounds throughout the whole meteor archwiſe, whoſe greateſt height was about 15°.

At 7h 45′ the flame-colour'd arch was much diminiſhed; the redneſs very evident and contiguous; tho' in ſome places of different intenſities, and viſibly increaſing about N. b. W. on each ſide of which there was a diſtinct ruddineſs.

At 7h 51′ the diſtinct redneſs about N. b. W. changed to a more intenſe uniform redneſs, which ſeemed to be by the union of the aforeſaid diſtinct area's; and the greateſt intenſity was in the middle ſpace between them, *viz.* N. b. W. At this juncture Mr. *Greenwood* was not a little ſurpris'd with an extraordinary flaſh of lightning, very bright, which began about the middle of this congregated vapour, and ran with an oblique undulatory motion for 20° towards the horizon.

At 8h 1′ the redneſs ſtill continued, but much abated.

At 8h 9′ the meteor was ſcarce to be diſtinguiſhed but by the *aurora*, which reach'd from N. W. to E. in ſuch ſort of curve, that the higheſt part was due north about 40° altitude. There was ſtill a reddiſh caſt N. N. W.

At 8h 30′ the colours were not very conſiderable, but the form entirely new: The breadth of the redneſs was from the pole-ſtar downwards about 20°; and from thence it ran tapering

ing on the left hand to W. b. N. and on the right to the E. in which points it was of no difcernible breadth. Its upper edge was of the deepeft red, which dilated by degrees to a flame-colour, and could fcarce be diftinguifhed from the neighbouring *aurora*. However there were 2 fpots, one to the right, and the other to the left, in an extenfive arch of a remarkable fadnefs.

At 9h 25′ this (in Fig. 10.) was an extraordinary beautiful appearance. From the zenith about 20° fouthward an uncommon rednefs was formed into a knot, or canopy, as it were, very diftinctly terminated (efpecially on the fouth parts) about 20° in length, which lay eaft and weft, and little lefs in its dimenfions north and fouth. From this iffued innumerable *ftriæ* throughout the northern hemifphere and farther, the horizontal limits being W. S. W. to E. S. E. Thefe *ftriæ* were difperfed in an exact order, proceeding from the aforefaid knot, as folds equally diverging, and each of the fame colour and brightnefs throughout the whole fpace to the horizon. The order of the colours was very agreeable, interchangeably blue, red, and then flame-colour; each of which was alfo diftinguifhed into *ftriæ* of various intenfities, from the deepeft to the lighteft blue, from the limits of violet, to a tincture of orange; and laftly, from the colour of the *aurora* to the brighteft flame-colour. And this order was repeated a vaft many times throughout the whole fcene. The whole was as bright, and in many refpects refembled a feries of rainbows vertically pofited; and in this view the generality of people will always remember it. And indeed were the heavens to be difpos'd into innumerable rainbows (excepting only the greater number of primitive colours) it would fcarce exceed this phenomenon in beauty: And the knot, from whence it feemed to proceed, far furpaffes any of the rednefs of that meteor, and even blood itfelf. Here it may not be amifs to obferve, that the weftern breeze had been for fome time before entirely lulled; nor was there the leaft motion in any part of the heavens.

The northern bank of vapours continued all along, and now reached from W. to E. by S. its greateft height being about 8°.

At 9h 35′ the blood-colour'd knot entirely vanifhed; tho' feveral of the defcending *ftriæ* remained entire, and in feveral places, parts of others; all in the fame direction, and of a fainter colour than before. The fky was perfectly calm and ferene.

At 9h 42′ the northern regions retained a bright *aurora*, interfperfed with a reddifh caft. From the zenith was diffufed a

very

very extenſive red vapour, reaching to the ſouthward near 30° from the zenith; and from thence converging towards the eaſtern and weſtern horizon, where it met, the one E. by S. and the other W. S. W. The ſouthern edge was of the deepeſt red, and the moſt diſtinct red was W. S. W. There appear'd a falling ſtar S. W. of a conſiderable duration.

At 10h 2′ the meteor was much advanced to the ſouthward, its greateſt height not being above 40° from the horizon: Its horizontal limits E. S. E. and W. by S. Its redneſs much abated; but the *aurora* was diffuſed every where throughout the ſcene, as conſpicuous to the ſouth, as towards the north parts of the zenith; which was an uncommon ſight. The ſky was now remarkably hazy, and full of vapours.

At 10h 18′ the *aurora* advanced conſiderably to the ſouthward of the red vapour, which now was much diluted, about 20° in breadth; a part of it at leaſt 50° to the ſouthward of the zenith, and tapering towards the eaſtern and weſtern horizon, where the limits were much the ſame as before.

At 10h 25′ the *aurora* (Fig. 11. in which Z denotes the zenith, and N. E. S. W. the horizon) ſeparated from the reddiſh vapour conſiderably in the upper parts, tho' joined in the horizontal, and not above 25° from the ſouth horizon. There was not any diſtinguiſhable red to the northward, but an arch of the *aurora* of much the ſame height, tho' much inferior in its horizontal meaſure. The ſouthern and northern *aurora* were each very bright. There were ſeveral tranſitory flaſhes in ſeveral parts of the red vapour. At this time the *aurora* ſeemed to appertain as much to the ſouthern as northern horizon, and the redneſs conſiderably more: But there was a conſiderable difference juſt towards the horizons; the one being covered with the duſkiſh vapour ſo often mentioned, and the other appearing of its natural blue colour.

At 10h 35′ the appearance was over, excepting a reddiſh caſt to the eaſtward, and a faint *aurora* in the northern regions, of but ſmall extent from the duſkiſh horizontal vapour.

At 11h 35′ there were no remarkable phenomena ſince the laſt. The northern *aurora*, with the duſkiſh vapour, ſtill continued, and Mr. *Greenwood* thinks, as evident as at any of the foregoing periods.

Here Mr. *Greenwood* ended his obſervations. He was informed by others, who were occaſionally on the water, that its beginning was juſt after ſun-ſet, in the form of an extended darkiſh cloud riſing northward; a few minutes after the

appear-

appearance of which, there was towards the eaſtern and weſtern regions a very diſtinguiſhable tincture of red. And the next change was Mr. *Greenwood*'s firſt obſervation.

At 11h 45′ it appear'd (as in Fig. 12.) in a new and very ſurpriſing form. The edge of the horizontal vapour was ſtrongly illuminated, as if it had been fired; and this was about 8° in height. From hence roſe up continually, following one another, very extenſive horizontal columns of a bright flame colour, which in ſcarce a ſecond of time reach'd, ſome to 40 others above 60° of altitude, and ſeveral to the intermediate altitudes. Each of theſe columns was as if a horizontal train of gunpowder had been ſuddenly fired, and the flaſhes regularly propagated to ſuch enormous heights in an horizontal poſition. And there were innumerable ſucceſſions of theſe riſing flaſhes, the phenomenon continuing nearly a quarter of an hour. This compariſon will alſo illuſtrate ſeveral other particulars at this juncture. Sometimes there were ſeveral of theſe flaſhes aſcending together, at a little diſtance from one another, as if there had been ſeveral horizontal trains ſucceſſively and almoſt inſtantaneouſly kindled one after another. Sometimes the riſing line of light would be continued horizontally throughout the whole ſcene; in other places 3 quarters, a half, a third, a quarter, *&c.* of the ſame length, as if theſe trains had been unequally extended. Sometimes the flaſh would begin in the middle, and run kindling to the extremities: Then at one extremity, moving towards the other; and at other times in more places than one: But in all theſe varieties, the horizontal motion ceas'd, and the whole became one uniform line, before it had paſſed the kindled edge of the cloud, which was not above 8°, as was obſerved before: And all this may be well repreſented by the aforeſaid trains of inflammable matter, ſometimes kindled in one place, ſometimes in another; but always propagated thro' the whole train, with ſo ſwift a motion, that there could be no conſiderable difference as to the height of one part above another. The greateſt extent of theſe horizontal flaſhes was from N. W. to N. E. After theſe phenomena the meteor aſſumed its uſual form, *viz.* a bright *aurora* ſettled upon a duſkiſh horizontal vapour.

At 2h the meteor was again formed into much the ſame ſhape, as was deſcribed at 9h, but conſiderably of fainter colours. It alſo vaniſhed again in the ſame manner.

At 6h 30′ the *aurora* continued till day-light; and the phenomena at different times, and without any certain periods, were much the ſame as has been deſcribed in one or other of the foregoing articles.

Mr. *Greenwood* concludes by obſerving, that the day, before this meteor, was very warm for the ſeaſon, tho' early in the morning there was a very conſiderable hoar-froſt: The morning after was remarkable for an abundant dew; the temperament of the air much the ſame as the preceeding day. About 8 o'clock the heavens ſerene and calm. Barom. 30.1. Thermom. $1\frac{38}{100}$.

In the figures Mr. *Greenwood* has attempted the ſtereographic projection of the moſt conſiderable ſcenes, which may be a conſiderable aſſiſtance to the imagination.

Mr. *Greenwood* compared theſe obſervations with what he could find relating to the *aurora borealis* in the *Philoſophical Tranſactions*, &c. and he thinks there are few particulars mentioned there, but what occurr'd in this ſurpriſing inſtance; ſome that are rare are confirmed, and a few are altogether new: But the chief advantage in theſe obſervations he takes to be in the proceſs, criſis and decay, which is ſo obvious in ſeveral of the moſt remarkable ſcenes.

An Account of the ſame; by Mr. Richard Lewis. Phil. Tranſ. N° 418. p. 69.

OCT. 22, 1730, about 6 o'clock in the evening, the north part of the hemiſphere appeared of a faint red, the horizon was very duſky, and this redneſs was terminated above by a very dark cloud.

As the night advanced, this meteor redden'd, till it became of as deep a colour as blood; and it ſpread itſelf to the north-eaſt. It continued all night; but about 2 o'clock in the morning, Mr. *Lewis* obſerved, that it ſent forth from its north part 2 or 3 ſtreams of a whitiſh colour, which ſhot up to the zenith. Theſe emanations looked much like the rays of the ſun, when they paſs thro' a dark cloud, when it is ſaid to be drawing water. He took it to be an *aurora borealis*, but it appeared much fainter than thoſe he obſerved in *England*.

Dr. *Samuel Chew* at *Maidſtone* told Mr. *Lewis*, that he had for ſome days paſt, at morning and evening, obſerved ſeveral ſpots in the ſun, very plainly with his naked eye; ſome of which ſeemed very large.

The Sequel of a Table, collected from several Observations, taken from the Year 1721 *to* 1729, *in nine Voyages to* Hudson's Bay *in* North America; *by Captain* Christopher Middleton. Phil. Transf. N° 418. p. 71.

THE following table shews the variation of the compass according to the latitudes and longitudes under-mentioned, accounting the longitude from the meridian of *London.*

Lat. D.	Lat. M.	Long. D.	Long. M.	Variat. D.	Variat. M.	
50	00	2 East		12	00	
49	30	0	00	12	00	
50	00	2 West		13	00	Obs.
50	00	4	00	13	00	ditto
50	00	6	00	13	00	ditto
51	00	8	00	14	00	ditto
51	00	14	00	14	00	ditto
52	00	12	00	15	00	Ac.
53	00	12	00	ditto.		ditto
54	00	12	00	ditto.		ditto
55	00	12	00	16	00	ditto
56	00	12	00	16	00	Obs.
57	00	12	00	17	00	ditto
58	00	12	00	17	00	ditto
59	00	12	00	18	00	ditto

Lat. D.	Lat. M.	Long. D.	Long. M.	Variat. D.	Variat. M.	
50	00	14	00	14	00	Obs.
51		ditto		14		
52		ditto		15		
53		ditto		15		Ac.
54		ditto		16		Obs.
55		ditto		16		Obs.
56		ditto		17		Obs.
57		ditto		17		Obs.
58		ditto		18		Obs.
59		ditto		18		Ac.

50	00	16	00	15	00	Obs.
51				15		Obs.
52				16		Ac.
53				16		
54				17		Obs.
55				18		Ac.
56				18		
57				19		
58				19		Obs.

50	00	24	00	20	00	Ac.
51				20		
52				20		
53				21		Obs.
54				21		
55				21		Ac.
56				21		
57				21		Obs.
58				22		
59				22		

Lat.		Long.		Variat.		
D.	M.	D.	M.	D.	M.	
50	00	18	00	17	00	Obſ.
51				17		
52				17		
53				17		
54				18		Ac.
55				18		
56				18		
57				19		
58				19		Obſ.
59				19		
50	00	20	00	18	00	Ac.
51				18		
52				18		Obſ.
53				19		
54				19		
55				19		
56				19		Ac.
57				19		
58				20		
59				21		Obſ.
50	00	22	00	19	00	Obſ.
51				19		Ac.
52				19		
53				20		Obſ.
54				20		Ac.
55				20		
56				20		
57				20		
58				21		Obſ.
59				21		
50	00	32	00	24	00	Ac.
51				24		
52				24		Obſ.
53				24		
54				25		
55				25		Ac.
56				25		
57				26		Obſ.
58				26		Ac.
59				26		Obſ.

Lat.		Long.		Variat.		
D.	M.	D.	M.	D.	M.	
50	00	26	00	21	00	Obſ.
51				21		
52				21		Ac.
53				21		
54				22		Obſ.
55				22		
56				22		Ac.
57				23		Obſ.
58				23		
59				23		
50	00	28	00	22	00	Ac.
51				22		
52				22		
53				23		Obſ.
54				23		
55				23		Ac.
56				23		
57				24		Obſ.
58				24		
59				24		
50	00	30	00	23	00	Ac.
51				23		
52				23		
53				24		Obſ.
54				24		Ac.
55				24		
56				24		
57				25		Obſ.
58				25		
59				25		Ac.
51	00	42	00	29	00	Obſ.
52				29		
53				30		
54				30		
55				30		Ac.
56				30		Obſ.
57				31		
58				31		
59				31		

Lat. D.	Lat. M.	Long. D.	Long. M.	Variat. D.	Variat. M.	
50	00	34	00	25	00	Obſ.
51				25		Ac.
52				25		
53				25		
54				26		Obſ.
55				26		Obſ.
57				26		
58				27		Ac.
59				27		
50	00	38	00	27	00	
51				27		Obſ.
52				27		Ac.
53				28		Obſ.
54				28		
55				28		Ac.
56				28		
57				29		Obſ.
58				29		
59				30		Obſ.
50	00	40	00	28	00	Ac.
51				28		Obſ.
52				28		
53				29		
54				29		Ac.
55				29		
56				29		
57				30		Obſ.
58				30		
59				30		
58	00	52	00	34	00	Obſ.
59				34		
60				34		
61				35		
62				35		

Lat. D.	Lat. M.	Long. D.	Long. M.	Variat. D.	Variat. M.	
52	00	44	00	30	00	Obſ.
53				31		
54				31		Ac.
55				31		
56				31		
57				32		Obſ.
58				32		
59				32		Ac.
53	00	46	00	31	00	Ac.
54				32		Obſ.
55				32		
56				32		Ac.
57				33		Obſ.
58				33		
59				33		
56	00	48	00	32	00	Obſ.
57				32		
58				32		
59				34		
60				34		
61				34		
57	00	50	00	33	00	Obſ.
58				33		
59				33		
60				34		
61				35		

Lat.		Long.		Variat.		
D.	M.	D.	M.	D.	M.	
58	00	54	00	34	00	Obſ.
59				35		
60				36		
61				36		
62				36		
58	00	56	00	36	00	Obſ.
59				36		
60				36		
61				37		
62				37		
58	00	58	00	36	00	Obſ.
59				37		
60				37		
61				37		
62				38		
63				38		
58	00	60	00	37	00	Obſ.
59				38		
60				38		
61				38		
62				39		
58	00	62	00	38	00	Obſ.
59				39		
60				39		
61				39		
62				40		
59	00	64	00	39	00	Obſ.
60				39		
61				39		
62				40		
60	00	66	00	40	00	Obſ
61				41		
62				43		
59	00	68	00	40	00	*Hudſon's*
60				43		
61				44		
62				47		

Lat.		Long.		Variat.		
D.	M.	D.	M.	D.	M.	Ob.
60	00	70	00	43	00	*Streights*
61				44		
62				47		
61	00	72	00	42	00	Obſ.
62				43		
63				48		
62	00	74	00	41	00	*Hudſon's Streights.*
63				48		
62	00	76	00	41	00	
63				47		
64				49		
62	00	78	00	40	00	
63				42		
64				49		
63	00	80	0	40	00	
64				49		
60	00	82	00	38	00	Obſ.
61				39		
62				40		
63				42		
64				44		
50	00	84	00	19	0	*In Hudſon's Bay.*
51				20		
51				21		
52				22		
53				23		
54				24		
55				25		
56				26		
57				27		
58				27		
59				28		
60				29		
61				30		
62				40		

Lat.		Long.		Variat.		
D.	M.	D.	M.	D.	M.	
55	00	86	00	22	00	Obs.
56				23		In *Hudson's Bay.*
57				24		
58				25		
59				26		
60				27		
56	00	88	00	22	00	
57				23		
58				24		
59				25		
60				26		

Lat.		Long.		Variat.		
D.	M.	D.	M.	D.	M.	
57	00	90	00	21	00	Obs.
58				22		*Hudson's Bay.*
59				23		
60				24		

Note, *The letters* Obs. *are the observations, and the letters* Ac. *are by estimation.*

An extraordinary Instance of the almost instantaneous Freezing of Water; *by M.* Triewald. Phil. Trans. N° 418. p. 79.

DEC. 15, 1730, M. *Triewald*, coming into the hall, in the palace of the Nobility at *Stockholm*, where his *apparatus* is placed (the weather being very cold) was afraid that the glass for shewing the experiment with the *Cartesian* devils (or those glass figures in water, which, by the pressure of the air on the surface of the water, are made to change their places, and sink to the bottom of the glass) would be in danger, if the water should freeze in it. He took it down from the shelf, and found the water in a fluid state: But before he would empty the glass (as some that were present had not seen that experiment) he placed his hand on the bladder tied on the top of this cylindrical glass, which was of a pretty large size, 16 inches high, and three inches and a half in diameter, containing three glass figures; and in that very instant, and in the space of a second of time, he found all the water turned into ice; when in that time two of the figures had reached very near the bottom, but the third, as well as they, was fixed in the middle of the glass, and surrounded with ice as transparent as the water itself before it congeal'd.

An Account of bulbous Plants flowering much sooner, when their Bulbs are placed upon Bottles, filled with Water, than when planted in the Ground; by the Same. Phil. Transf. N° 418. p. 80.

IN *September* 1730, M. *Triewald* placed fome bulbs of tulips, and other flowers, in water, (as reprefented Fig. 13, 14. Plate VI.) at which time he put into each glafs two grains of faltpetre. He kept thefe glaffes in his ftudy, fometimes on a fhelf, at other times before the windows. In a fortnight's time he began to find that they ftruck new roots; the latter end of *November* they put forth leaves, and in *January* they all flowered, as well as if they had been on a garden-bed: Whereas in gardens in *Sweden* we feldom fee tulips before the latter end of *May*; and this year, namely 1731, they are later; the ground being ftill cover'd with a deal of ice and fnow.

Tho' thefe experiments feem to be calculated for nothing but amufement; yet M. *Triewald* thinks they have furnifh'd him with fome light, as to the rife of the fap in plants. *Vide*. the Fig. 13, 14. Plate VI.

Experiments relating to the fame Subject; by Mr. Philip. Miller. Phil. Tranf. N° 418. p. 81.

THE glaffes, marked N° 1. were roots of a hyacinth, commonly known by the name of *pulchra*; N° 2. were roots of the common oriental blue hyacinth. The flowers of thefe were not fo large, as they are commonly produced, when planted in a bed of earth; but this was occafioned by the bulbs dividing into feveral off-fets; each of which are as fo many different fmall roots, fending forth ftems or leaves. N° 3. was a bulb of a tulip, which tho' placed on the glafs of water at the fame time as the hyacinths, yet was not likely to flower in a month. N° 4. a root of *Narciffus*; this was likewife as backward as the tulip, tho' placed on the glafs of water at the fame time with the hyacinths; thefe roots were placed upon the glaffes the beginning of *November* 1730; at which time Mr. *Miller* put them into a green-houfe, where the air was kept conftantly in a temperate warmth. The glaffes were fill'd with common *Thames* water, fo near the top, that when the bulbs were placed upon the glaffes, it might be about $\frac{1}{4}$ of an inch below the bottom of the bulbs. Into thofe glaffes, markt N° 5. he put a fmall quantity of common

common garden-mould, to try whether that would forward their flowering, or increase their strength; but he found that all the roots, placed on those glasses, into which the earth was put, were at least a fortnight later than the others before their fibres were emitted; and their progress was since much slower. He also observ'd, that the water in those glasses, where the earth was put, did not waste above half so fast, as it did in those glasses where there was none; which he conceives might be owing to the terrestrial matter mixing with the water; and so rendering it thicker, and less capable of being attracted by the plants, or evaporating by the heat. And from those glasses, where the bulbs did not exactly cover their necks, the water evaporated much faster than from those where the bulbs did entirely cover the tops of the glasses; so as to leave no vacuities round them.

In about a month, after the roots were put upon the glasses of water, they began to put out their fibres into the water; but they did not begin to put forth their leaves, till their fibres were extended all over the glasses, and were almost as full grown as at present. When their leaves began to appear, the buds of the hyacinth-flowers were soon visible, and in about three weeks time were fully blown. The tulips and *Narcissus*'s being much more backward than the hyacinths (as they always are when planted in a garden) these should always be placed upon the glasses of water six weeks, or two months earlier in the season than the hyacinths, when they are designed to flower at the same time, and the *præcoces* (or early blowing) tulips should always be chosen for this purpose.

By this method a person, who has not a garden, may have some of these flowers growing in his chambers; where, if they are not kept too close from the air, or in a place too warm, they will flower almost as well as in a bed of earth, provided the roots are good, and renew'd every year; especially the tulips, because they form new bulbs every year, the old ones being always exhausted in nourishing the leaves and flowers, a new bulb is annually produced by the side of the flower-stem. Mr. *Miller* has observ'd the hyacinths to flower two years successively upon glasses of water; but their flowers are very weak the second year: So that is is much the better way to have fresh roots every year.

The

The simple Laurel-water, *found to be a dangerous Poison; together with several Experiments made therewith on* Dogs; *by Dr.* Madden; *as also an* Antidote *to this Poison; by Dr.* Rutty. Phil. Transf. N° 418. p. 84.

A Very extraordinary accident that happened at *Dublin*, discover'd a most dangerous poison, and which was never before known to be so, tho' it hath been in frequent use; and that is the simple water, distill'd from the leaves of the *lauro cerasus*. It is at first of a milky colour, but the oil which comes over the helm with it, being in a good measure separated from the phlegm, by passing it thro' a flannel-bag, it becomes as clear as common water.

It has the smell of a bitter almond, or peach-kernel; and has been for several years in frequent use among housewives and cooks, to give that agreeable flavour to their creams and puddings. It has likewise been much in use among drinkers of drams; and the proportion they generally use it in, has been one part of laurel-water to four parts of brandy.

Nor has this practice (however frequent) ever been attended with any apparent ill consequences, till some time in *September* 1728, when it happened that one *Mary Whaley* drank some of this water; and in about a quarter of an hour after, she complained of a violent disorder in her stomach; and from that time she lost her speech, and died in about an hour, without vomiting, or purging, or without any convulsion.

Anne Boyse, who had also drank of it, died, without the least groan or convulsion.

One *Frances Eaton*, who, had drank somewhat more than a spoonful, found no disorder in her stomach, or elsewhere; but to prevent any ill consequence, she took a vomit immediately, and has been well ever since.

The Dr. went to see *Anne Boyse* about 24 hours after her death; but he could not prevail to have her opened. She was about 60 years of age; her countenance and skin appear'd well coloured, and her features were hardly altered: So that she look'd like one asleep. Her belly was not swelled, nor had she any other external mark of poison.

Another accident of the like nature happened about four years before in the town of *Kilkenny*. A young gentleman, son to one Mr. *Evans*, mistook a bottle of this laurel-water for a bottle of ptisan. It is uncertain what quantity he drank, but

but he died in a few minutes, complaining of a violent disorder in his ſtomach. This affair was not much regarded at that time, becauſe he laboured under a diſtemper, to which, or to an improper uſe of remedies, his death was attributed by thoſe about him.

The Dr. in order to ſatisfy himſelf farther, as to the effects of this poiſon, made ſome experiments, in conjunction with a few of his friends; an account of which is as follows.

Experiment 1. *October* 3, 1728. We gave a large ſetting dog three ounces of laurel-water by the mouth. In three minutes he began to be ſtrongly convulſed. His convulſions continued about five minutes, after which the Dr, untied him; he then fell into a moſt violent difficulty of breathing, which laſted about eight minutes, and abated gradually; upon which he endeavoured to raiſe himſelf, but could not. The Dr. tied him down again, and gave him an ounce and a half more, upon which he ſunk at once; and without any return of his convulſions, or difficulty of breathing, he expired in two minutes.

Upon opening the ſtomach, the Dr. found therein the whole quantity of water he had taken; its ſurface was cover'd with froth, but it was not otherwiſe alter'd in its colour, conſiſtence, or ſmell. The inſide of the ſtomach was not at all inflamed, nor was there any viſible alteration in the *tunica villoſa*.

The veins of the ſtomach, all the meſaraic veins, and likewiſe the *cava*, were much diſtended with blood; the arteries, on the contrary, were remarkably empty. The liver and gall-bladder were no wiſe altered. The kidneys were unuſually full of blood, and appear'd of a blueiſh colour, almoſt as deep as that of the violet-plumb. Upon making an inciſion into one of the kidneys, the blood flowed in much greater plenty, and was more fluid than uſual. In the heart there appeared nothing preternatural. The brain was nowiſe altered.

Exp. 2. *October* 24. We gave an ounce and a half of the ſame water to a bitch of a ſmaller ſize; ſhe was immediately let looſe, and in two minutes ſhe loſt the uſe of her limbs. She attempted ſeveral times to raiſe herſelf and walk, but ſhe ſtaggered and reel'd about, and then fell down. She repeated this inceſſantly about five or ſix minutes. At laſt ſhe was violently convulſed, eſpecially in the muſcles that extend the head and ſpine. For about the ſpace of a minute

ſhe

ſhe had that ſort of convulſion, call'd *opiſthotonos*, the back of her head being drawn almoſt to her tail.

After this ſhe vomited plentifully, and her convulſions ceas'd. She then lay ſtill for ſeven or eight minutes, labouring for breath (tho' not ſo violently as in the former caſe) and foaming at the mouth. We gave her an ounce more of the water; upon which her difficulty of breathing increaſed, and ſhe died in two minutes.

Upon opening the *abdomen*, the *thorax* and head, we found every thing in the ſame ſtate, as in the former inſtance.

Exp. 3, *October* 25. We gave two ounces of the water to a dog of the ſame ſize with the former, which produced the like appearances as in the foregoing caſe. This dog was half an hour a dying; for the doſe was not repeated; becauſe he did not vomit up what he had taken. Upon opening him, we found every thing in the ſame ſtate as in the former inſtance.

Exp. 4. *October* 26. We gave two drachms and a half of the water to a dog of a middle ſize, and immediately untied him. He then ran about the room very briſkly for about a minute, and ſeemed to be nowiſe affected with it; yet he ſoon loſt the uſe of his limbs. He often attempted to raiſe himſelf and walk, but ſtill fell down again before he had mov'd two yards from the place.

After this he vomited plentifully, conſidering that he had faſted 24 hours; upon which he was ſiezed with a convulſion more violent than any of the former dogs, eſpecially in the muſcles that extend the head and ſpine. Theſe convulſions continued about eight or ten minutes; upon their ceaſing he lay ſtill, breathing deeply, tho' regularly, and ſeemed to be aſleep. In about ten minutes he rais'd himſelf, took ſome food, and walked about tolerably well. We left him, and returning three hours after we found him perfectly recover'd.

Exp. 5, *October* 28. We injected an ounce of the water into the *rectum* of a ſtrong ſpaniel, and let him looſe. In the ſpace of two minutes he began to loſe the uſe of his limbs, and to ſtagger as the others had done. He was convuls'd more violently than any of the reſt, and chiefly in the muſcles of the neck and ſpine. The muſcles of his eyes were ſtrongly convuls'd; which appearance was not obſerv'd in the other dogs: He foamed at the mouth, yell'd frequently, and breathed with more difficulty than any of the reſt. His convulſions continued 20 minutes; upon their ceaſing he lay quiet, as tho' he ſlept, only that his eyes were open. His limbs were now become perfectly paralytic. We rais'd him up ſeveral times, and ſet him on his legs; but he did not attempt to uſe them. He continued in this way about 15 minutes longer; and then he was ſeized with another violent convulſion, which in 5 minutes put an end to his life.

Upon opening the *abdomen*, we found the veins of the ſtomach and guts very much diſtended with blood, as in all the former inſtances: There was no viſible alteration in the heart, lungs, and brain.

Exp. 6. *October* 30, we injected an ounce and a half of the water, diluted with 3 ounces of common water warmed, into the *anus* of a ſmall bitch: Before we could untie her, ſhe was ſeized with convulſions, and yelled much. She fell as ſoon as ſhe was looſened, and never after endeavour'd to riſe. She had convulſions and great difficulty of breathing for about 2 minutes: She then lay ſtill, with her limbs ſtiff and extended about 3 minutes; during which time her lower jaw was convulſed, and pulled alternately to and from the upper jaw, with a very quick motion.

After this her limbs became paralytic, and ſhe gaſped for breath about 2 minutes longer. She was quite dead in 7 or 8 minutes from the injection of the clyſter.

In the *abdomen*, *thorax*, and brain, every thing appeared as uſual.

Exp. 7. *November* 2, we injected ½ an ounce of the water, diluted with 3 ounces of common water warmed, into the *anus* of a ſmall bitch: In the ſpace of 4 minutes ſhe began to breathe with difficulty: We let her looſe, but ſhe was not able to ſtand, or walk without ſtumbling: The muſcles that extend the head were convulſed, and her fore-legs were affected for 3 or 4 minutes with a *tetanus*, but had no convulſive motion: She vomited and purged plentifully. She did not yell, nor ſeem to ſuffer much pain, nor did ſhe loſe her ſenſes all the time. In half an hour ſhe recover'd.

Exp. 8. The next day, we injected a drachm of the water into the external jugular of the ſame bitch: She was ſeiſed with convulſions as violent as the former, before we could untie her: They laſted about 5 minutes; after which ſhe recover'd gradually, and continued well.

Exp. 9. *November* 20, we injected 4 ounces of the water without any dilutions by the *anus*, of a ſtrong dog of a middling ſize. In leſs than 2 minutes after the injection, he was ſeized

ſeized with convulſions, and difficulty of breathing. He fell to the ground as ſoon as his convulſions began, and never once attempted to riſe; nor were his convulſions in any ſort ſo violent, nor did they continue ſo long as in the former inſtances: He bled at the noſe about 4 ſpoonfuls; the blood was of a very bright florid colour; his convulſions laſted about 4 minutes; after which he became entirely paralytic, and died in 5 minutes more.

We found the ſtomach, inteſtines, liver, *&c.* in the ſame ſtate as thoſe abovementioned. Upon cutting about an inch from the lower part of one of the lobes of the lungs, the blood flowed from it in great plenty, and appeared more florid and fluid than uſual.

Exp. 10. *December* 14, we gave 5 ounces of laurel-water by clyſter to a dog, ſomewhat of the ſize and ſhape of the *Italian* greyhound. He ſeemed at firſt to be noways affected thereby; but in about 5 minutes he began to droop, and loſe the uſe of his limbs. He did not once yell, or ſtruggle, as the others had done, but ſunk gradually, till he became at laſt entirely paralytic. He had not any convulſion, only a kind of *ſpaſmus cynicus*, a few minutes before he died; which happened in half an hour after the injection of the clyſter.

Upon opening the *abdomen*, we found the veins much diſtended with blood, as were alſo the veins and *ſinus*'s of the brain.

Exp. 11. *December* 19, we gave 3 ounces of the water in the ſame manner to a cur of the lap-dog ſize: He died in 7 minutes, without any convulſion, only a *tetanus* in the muſcles that extend the head.

The *lauro-ceraſus* being an ever-green, and abounding with a hot eſſential oil, we imagined that other ever-greens might partake of the ſame poiſonous quality: Accordingly we made trial of a water, diſtilled in an alembic, from the leaves of the yew-tree, ſo much talked of by the ancients; and whoſe very ſhade they ſuppoſed to be fatal to thoſe who ſat or ſlept under it.

Exp. 12. We gave 3 ounces of this water by clyſter to a very ſmall cur-dog, but he was not in the leaſt affected thereby.

Exp. 13. We alſo gave a young ſpaniel by the mouth, 2 ounces of a water, diſtilled from the leaves of the bay-tree, without any effect.

Exp. 13. We afterwards made an experiment with the diſtill'd water of box-leaves, which had a very ſtrong narcotic ſmell:

ſmell: We injected 5 ounces of this water by the *anus* of a ſmall cur-dog; but he was noways affected thereby, tho' we kept him 12 hours after the operation.

The 2 following experiments were communicated to Dr. *Madden*, by Dr. *Stephens*.

Exp. 15. Being deſirous to know, whether the virulency of laurel-water were owing to the fire in diſtillation, we poured warm water upon ſome laurel-leaves bruiſed, and made a ſtrong infuſion of them. We pour'd an ounce of it down a dog's throat, half of which was ſuppoſed to enter the ſtomach, and 5 minutes after, another ounce was given him in like manner: The dog ſeemed to be ſomewhat ſick at his ſtomach, but was ſoon as lively as ever. A few minutes after this, another ounce was given him by the mouth, of which we ſuppoſe a fourth part to have been loſt. He ſoon after ſtared, and trembled very much. In 5 minutes after, another ounce was given him; upon which he trembled as before, but in a little time he appeared eaſy and lively.

Imagining that theſe ſmall quantities loſt their power, during the intervals of giving them, in 10 minutes after his taking the former doſe, we pour'd down his throat 2 ounces and ½ at once: He immediately tumbled on his back convulſed, and tumbled over 3 or 4 times, but quickly returned to his feet: He ſtaggered, his eyes ſtared, and he ſat down like a dog that is tired. At length he ſhut his eyes, his neck became extended, and we apprehended he was falling into convulſions; but inſtead thereof he vomited a vaſt quantity of undigeſted chyle, in which appeared a great portion of the infuſion; after which he ſeemed to be perfectly recovered.

Exp. 16. In about 25 minutes after, we gave the ſame dog by the mouth 2 ounces of the juice, expreſs'd from laurel-leaves; and in about 10 minutes more, another ounce was given him in the ſame manner: In a few minutes he began to loſe the uſe of his hinder legs, but he quickly recovered them. Upon his taking another ounce ſoon after the former, he fell into a great difficulty of breathing, and yell'd much. After this he was ſeiſed with very ſtrong convulſions, which affected his lower jaw and hinder legs very remarkably.

In about the ſpace of 5 minutes, theſe convulſions were ſucceeded by an entire reſolution of all the limbs; he breathed with great difficulty and very ſlowly; no appearance of expiration: Sometimes we obſerved 2 attempts at inſpiration without intermiſſion, or cloſing of the mouth. At other times there

was

was near the ſpace of a minute between 2 inſpirations. After this he was ſeized with a trembling in his limbs; and in about ¼ of an hour from his taking the laſt ounce, he died without any ſtruggling, with his tail extended.

There were ſeveral other experiments made of the ſame kind, by ſome Gentlemen of the profeſſion, which exactly correſponded with the foregoing, excepting this one circumſtance, that they were of opinion, that this poiſon occaſioned an inflammation in the ſtomach and guts.

In order to clear this diſpute, we, who were of a different opinion, put together the following hints, from which it appears that the fact is not as they imagined; and that tho' we find, upon an animal's being killed by this poiſon, that the veins are very much diſtended with blood, yet there is not any inflammation produced by it.

Nothing ſeems better to illuſtrate this matter, than the analogy which may be obſerved between the convulſions, occaſioned by the epilepſy, and thoſe which are the effect of laurel-water. For inſtance, in the epilepſy, the body is univerſally convulſed; eſpecially the muſcles of the neck, tongue, lower jaw, and thoſe of the arms.

The effect of theſe convulſions is this: The heart beats with unuſual violence and frequency; the neceſſary conſequence of which is, that the blood will be thrown in greater plenty from the arteries into the veins. But becauſe the muſcles compreſs the veins more than the arteries (whoſe ſyſtole enables them to overcome that preſſure) therefore the blood, which is ſtill puſh'd forward by the ſyſtole of the heart into the veins, will be retained there by the aforeſaid preſſure of the muſcles, and will return in a very ſmall quantity to the heart.

For inſtance, the abdominal muſcles, being convulſed, preſs the ſtomach and inteſtines upon the aſcending *cava*, and likewiſe upon the *vena portæ*; by which means the blood, returning from the lower extremities, is retained in thoſe veſſels. Accordingly we ſee the viſible and immediate effects of this preſſure are the forcing out the contents of the bladder and inteſtines, and frequently the *profluvium ſeminis*.

In like manner the preſſure of the muſcles of the neck, tongue, and lower jaw, upon the jugular veins and their branches, will not ſuffer the blood to return to the heart by the deſcending *cava*.

To this we may add the preſſure of the diaphragm and ribs upon the lungs; by which means the trunks of the aſcending and

and descending *cava* are compressed at their insertion into the heart.

Hence follows that frightful blackness of the face during the paroxysm, and the prodigious swelling of the veins of the head; especially the temporal veins.

The necessary consequence of all this must be, that if the convulsion last long enough the patient must die, on account of the blood being thrown out of the arteries into the veins, and not returning to the heart. And Dr. *Madden* questions not that if such a person were opened after death, we should find the *cava*, the *vena portæ*, the veins and *sinus*'s of the brain, together with all their smallest ramifications, very much distended with blood, and the arteries on the contrary almost empty.

But if the epileptic convulsion cease before the circulation of the blood is entirely stopped, then all becomes calm again, the pressure is taken off the veins, the blood returns to its usual course; and in a few hours the sick person is perfectly recover'd

And yet all this violent convulsion of the body, this prodigious distension of the veins, and interception of the course of the blood, happen without any inflammation, as appears from the speedy recovery of the patient: For, if the convulsion had occasioned an inflammation, a fever must necessarily have ensued, which would discover itself by manifest tokens, and would require a much longer time for its abatement.

Let us now observe the analogy between these appearances, and those produced by laurel-water.

We find by experiment, that an ounce, or even two drachms and a half, of laurel water will occasion more violent convulsions than 3 or even 5 ounces of it (*Exp.* 4, 5 to 11.) If therefore an inflammation were the necessary consequence of this water being taken into the stomach or guts, the more violent the convulsion is, the greater the inflammation ought to be.

On the contrary we find, that the more violent the convulsion is, the greater the probability that the animal will recover (*Exp.* 4. to 7.) And when it falls out so, the manner is exactly the same as in the recovery of an epileptic person. In a few minutes the animal becomes as brisk, as if no such thing had happened.

Now if an inflammation were at all the necessary consequence of this poison, tho' the animal recover; yet there must be some inflammation, more or less, produced; which must occasion more

more violent and laſting ſymptoms. But ſince none ſuch appear; ſince the recovery is ſo ſudden and effectual, it is the ſtrongeſt and plaineſt argument that there is not any inflammation produced.

If the laurel-water be adminiſter'd to the quantity of an ounce or more, the animal unavoidably dies in a few minutes; and upon opening him the appearences are theſe; namely, both the trunks of the *cava*, and all the ramifications of the meſeraic veins are very much diſtended with blood. Theſe veſſels are eaſily diſtinguiſhed from the arteries, not only by the thinneſs of their coats, but alſo by the colour which the blood exhibits to the eye. Now Dr. *Madden* conceives that all inflammations have their beginning in the arteries; and that they are produced (becauſe there is no free paſſage for the blood) into the veins: But if once this paſſage become free (as in this caſe it certainly is; for, we find all the veins diſtended with blood beyond their natural dimenſions) the inflammation is then at an end, the cauſe which produced it being taken off.

Moreover, the fact laid down, namely that the veins are preternaturally diſtended with blood, does neceſſarily conclude, that the arteries are not diſtended with it; and conſequently that there cannot be any inflammation: For, if the quantity of blood be increaſed in the veins, it muſt be proportionably diminiſh'd in the arteries.

To what has been ſaid, may be added the following obſervation; *viz.* that if there were any inflammation produced by this poiſon, it ought to appear moſt remarkable on the inſide of the ſtomach and inteſtines; becauſe of the immediate contact it has with thoſe parts.

All other poiſons, which occaſion inflammations in the ſtomach and guts, do firſt operate upon the blood-veſſels, and corrode the parts inflamed; they occaſion vomitings and fluxes of blood, which at length terminate in convulſions.

One may very eaſily be deceiv'd upon opening the ſtomach of a dog, and may miſtake the redneſs of the *tunica villoſa* for an inflammation.

The inner coat of a dog's ſtomach is naturally of a ruddy fleſh-colour; and therefore of all domeſtic animals a dog has the quickeſt and ſtrongeſt digeſtion: Accordingly we ſee that they ſwallow bones, and digeſt them perfectly well; and tho' they be but half chewed, when taken into the ſtomach; yet they are at laſt reduced to as ſoft a conſiſtence as any other part of their aliment. It is, for this reaſon therefore, that the ſtomachs of dogs are more plentifully ſupplied with blood than thoſe of other animals; by which means not only the muſcular force of the ſtomach, but likewiſe its warmth, which is the principal inſtrument of digeſtion, is very much increaſed.

Bole, vinegar and milk, were given to a dog which had ſwallow'd ſome of the laurel-water: The bole and vinegar were not obſerved to do much good; but the dog, which drank the milk, recover'd without any bad ſymptoms: But at that diſtance of time Dr. *Rutty* could not recollect the proportions that were given: He thinks a pint of milk.

An Account of M. Le Blon's *principles of Printing (in imitation of Painting) and of Weaving* Tapeſtry, *in the ſame Manner as* Brocades; *by Dr.* Mortimer. Phil. Tranſ. N° 419. p. 101.

M. *Le Blon*, endeavouring to fix the true harmony of colouring in painting, found that all viſible objects may be repreſented by the 3 primitive colours, red, yellow, and blue: For, out of them all others, even black itſelf, may be compounded. We are beholden to the great Sir *Iſaac Newton* for the diſcovery of the difference of colours, contained in the rays of the ſun; and that the union of them all produces white, which is light itſelf.

For diſtinction ſake M. *Le Blon* calls thoſe colours, which are comprehended in the rays of the ſun, impalpable colours; and thoſe uſed in painting, material colours. In the material colours a mixture of all 3 produces a black, or darkneſs, contrary to what is obſerved in the impalpable, which, as has been ſaid, produce white.

M. *Le Blon* takes this phenomenon to be owing to the body or ſubſtance, of which theſe 3 material colours conſiſt, and to their particles being opaque, and not tranſparent: For, they only reflect certain rays of light, that ſtrike on their ſurfaces; and therefore when ſmall particles of different colours are placed cloſe together, if they are ſo ſmall that each of them cannot be ſeen ſeparately by the eye, we do not diſcern the colour of each particular atom, but only the blended reflected rays, proceeding from the adjoining particles: Thus yellow and red produce an orange; yellow and blue a green, &c. which ſeems to be confirmed by placing 2 pieces of ſilk near each other; *viz.* yellow and blue; when by intermixing of their

reflected

flected rays, the yellow will appear of a light green, and the blue of a dark green; which deserves the farther consideration of the curious.

M. *Le Blon* has reduced the harmony of colouring in painting to certain infallible rules, built on this foundation: Whereas according to the common practice of painters, their colouring is the effect of mere chance, or guess-work at first, but improved by experience; all painters usually affirming, that there can be no certain rules given for mixing colours: M. *Le Blon* published, some years ago, an ingenious book on this subject, intituled, *Coloritto*, or the *harmony of colouring in painting*.

By these rules M. *Le Blon* light on the manner of printing any object in its natural colours, by means of 3 plates, and of the 3 primitive colours; an art attempted and sought after ever since the invention of printing; but in vain, and thought impossible, till he put it in practice about 15 years ago. The plates are engraved chiefly after the *mezzotinto* manner; only the darker shades, and sometimes the out lines, where they are to appear very sharp, are done with a common engraver. Each plate is not compleatly engraved, but only contrived to take such a portion of the colour, as is necessary with the other 2 plates to render the picture compleat.

This art of printing consists in 6 articles, *viz.* 1. To produce any object with 3 colours, and 3 plates. 2. To make the drawings on each of the 3 plates; so as that they may exactly tally. 3. To engrave the 3 plates; so as that they cannot fail to agree. 4. To engrave the 3 plates in an uncommon way; so as that they may produce 3000, and more good prints. 5. To find the 3 true primitive material colours, and to prepare them; so as that they may be imprimable, durable, and beautiful. 6. To print the 3 plates; so as that they may perfectly agree in the impression.

The first of these is the most considerable, comprehending the theoretical part of the invention; and the other 5 subserve to bring it into mechanical practice; and of such importance, that if any one of them be wanting, nothing can be executed with success, or exactness. Sometimes more than the 3 plates may be employ'd, namely, when beauty, cheapness, and expedition require it.

The observation of the compounded colours, reflected from 2 pieces of silk of different colours, placed near each other, first gave M. *Le Blon* the hint of what the effect of weaving threads of different colours would be, when all the threads were ſo fine as not to be diſtinguiſhed at a ſmall diſtance from one another.

By the ſame principles of producing any viſible object with a ſmall number of colours, he arrived at the ſkill of producing in the loom all that the art of painting requires: An art that has alſo been often attempted, but as often abandoned, and declared impoſſible till now, as well as the other of printing in colours. And it is probable, many improvements may from hence be made in ſeveral trades, eſpecially in combing of wool, where the mixing of ſeveral colours may be of conſiderable uſe: But M. *Le Blon* has not hitherto had time to apply it to any thing elſe, beſides painting, printing, and weaving.

The colours made uſe of in weaving being only ſuperficial, and ſo different from both the impalpable and material colours; and not being to be ſo cloſely joined, or incorporated together as thoſe, will not of themſelves produce a white or black, but only a light cinnamon: Wherefore, in weaving he hath been obliged to make uſe of white and black threads, beſides red, yellow and blue; and tho' he found he was able to imitate any picture with theſe 5 colours, yet for cheapneſs and expedition, and to add a brightneſs where it was required, he found it more convenient to make uſe of ſeveral intermediate degrees of colours.

There are 2 ways in uſe at *Bruſſels*, and at the *Goblins* in *Paris*, for making tapeſtry after the common manner: One they call the flat way, and the other the upright. In the flat way they have the warp ſtretch'd in a frame lengthwiſe of the piece; it is made of white worſted, and the pattern lies cloſe under it: So that the workman can ſee the figures through the warp: He is provided with bobbins of ſilk or worſted of various colours, as the piece requires; then he takes up with his fingers one thread after another, as they anſwer to any colour in the painting underneath; and with the other hand paſſes the bobbin with the ſame colour, and ſtrikes the threads cloſe with an ivory comb. Some of theſe frames are made like a loom, with a warp paſs'd thro' the leiſhes and tredles for the feet, with which they open the threads of the warp, to paſs a common ſhuttle thro' them, when it is neceſſary to make a long throw, as is required in grounds, pillars and tall uprights.

In the upright way the warp runs from top to bottom of the piece; the pattern is placed upright; and cloſe behind it, and the outlines are drawn in charcoal upon the foreſide of the warp. The workman is placed with his back to the light, by which

which means he can ſee the pattern better; then he takes up the threads one by one, and paſſes the bobbin, as in the other way, and ſtrikes it cloſe with the comb: All which is near as tedious as needle-work itſelf; which is the reaſon why fine tapeſtry comes to ſuch high prices; and what can be had at a moderate price is always coarſe, and of a low taſte: For, workmen who have any good notion of painting, and are capable of adjuſting the colours, are not to be had but for exceſſive wages; which does likewiſe much enhance the price. But in M. *Le Blon*'s new way of weaving tapeſtry in the loom with a draw-boy, it may be performed almoſt as expeditiouſly as fine brocades: For, when the loom is once ſet and mounted, any common draught-weaver, tho' not acquainted with drawing or painting, nay, hardly knowing what figure he is about, exactly produces what the painter has repreſented in the original pattern: And thus a piece of tapeſtry may be wove in a month or two, which in the common way of working would take up ſeveral years; and what in the common way coſts 1000 pounds may, by this means, be afforded finer and better for 100.

The main ſecret of this art conſiſts in drawing the patterns, from which any common draught-weaver can mount the loom; and when that is done, the piece may be had of any ſize, by only widening the reeds and the warp; and a reverſe may be made with the ſame eaſe; which is done by the boy's pulling the leiſhes up again in the ſame order in which he pulled them down before; by which contrivance the tapeſtry may be ſuited to any room, whether the light comes in on the right hand or on the left.

The patterns are painted upon paper, on which are printed ſquares from copper plates, and theſe ſubdivided by as many lines, as anſwer to the threads of the warp, which run lengthwiſe of the piece; then they try how many threads of the ſhoot anſwer in breadth to every ſubdiviſion of the ſquares: Every thread of the warp goes thro' a ſmall braſs ring, call'd a *male*, or thro' a loop in the leiſh, and hath a ſmall long weight or lingoe hung below to counter-balance the pack-threads, which, going from the top of the rings or loops, are paſſed over the pullies in the table, directly over the loom, and are continued nearly in an horizontal poſition on one ſide of the loom, to a convenient diſtance; where they are all ſpread on a croſs-piece, faſtened to 2 ſtaples: Theſe are called the tail of the mounture; and from each of theſe packthreads, juſt by the ſide of the loom, are faſtened other packthreads, called ſimples, which

which deſcend to the ground: So that by pulling theſe ſimple chords, you raiſe any of the threads of the warp at pleaſure; Wherefore they faſten a loop or potlart to as many of theſe ſimple chords, as there are threads of the warp to be pulled up at every ſhoot or every throw of the ſhuttle; by which means the ſhoot ſhews itſelf on the right ſide, where the warp is pulled up: And in ordering this they are guided by the pattern, on which they count the diſtances of the ſubdiviſions, which contain the ſame colours in the ſame line, and can be ſhot at once; then they faſten potlarts to the ſeveral ſimple chords, that draw up the rings, thro' which theſe threads of the warp run, which are to lie behind this colour; they tie all theſe loops together, and faſten a piece of worſted, or ſilk to the knot, of the ſame colour with that the workman is to throw; and the boy, when he pulls each loop, names the colour, that the weaver may take the proper ſhuttle; and ſo on for every colour to be thrown.

The Sequel of the Account of the Cinnamon Tree in Ceylon; *by M.* Seba. Phil. Tranſ. N° 419. p. 106.

M. *Seba* having ſome years before, bought out of the *Eaſt India* warehouſes at *Amſterdam*, a conſiderable quantity of cinnamon leaves, or *folia malabathri*, pack'd up in ſeveral large cheſts, he happened to find in one of them the flowers of the cinnamon (as big as the *Italian* bean-flowers, and of a blue colour) as alſo the fruit.

In 1721, 1723, he bought of the ſame company the oil which is expreſs'd out of the fruit of the cinnamon-tree, as alſo that which is boil'd out of it, which is of a very good conſiſtence, and of a white colour; and by the *Eaſt India* company call'd cinnamon wax; becauſe the King of *Candia* cauſes candles to be made out of it, which for their agreeable ſcent are burnt only by himſelf and at his court: However, he permits his ſubjects to expreſs the juice out of another fruit, not unlike that of the cinnamon tree; but this being only a thin fat ſubſtance, like oil of olives, they cannot burn it any otherwiſe than in lamps.

The *Indians* likewiſe make uſe of this cinnamon wax in phyſic; and give it inwardly in luxations, fractures, falls, contuſions and bruiſes; that in caſe any inward part be touched or bruiſed, it may by its balſamic virtue be healed. They likewiſe give it in bloody fluxes to a drachm, or a drachm and a half: Outwardly applied it makes the ſkin

more

more beautiful, ſmooth, and ſoft than any one ſort of pomade. The leaves of the cinnamon tree likewiſe yield an oil, which is of a bitteriſh taſte, reſembling oil of cloves, mixt with a little good oil of cinnamon. It is call'd *oleum malabathri*, or oil of cinnamon leaves. It is an aromatic, and reckoned an excellent remedy in head-aches, pains of the ſtomach, and other diſtempers.

The oil of the root of the cinnamon tree is, properly ſpeaking, an oil of camphire; the roots affording a good quantity of camphire. M. *Seba* bought a bottle of it of the *Eaſt India* company, where there were ſeveral together in a box, upon which was written in *Low Dutch*, *Deſe oliteyten ſyn tot een geſchenk uyt Candia geſchikt*; that is, *theſe oils were ſent as a preſent out of Candia*; which ſhews that they are genuine, without any adulteration.

If this oil be diſtill'd in glaſs veſſels, there comes over along with it that ſort of camphire, the *Indians* call *camphire baros*, or camphire of *Borneo*, which ſhoots into thin tranſparent cryſtals, forming a beautiful variety of trees on the recipient, not unlike thoſe, which in very froſty weather are to be ſeen upon windows. This ſort of camphire is of very great efficacy in phyſic, and gather'd and kept for the King of *Candia*'s own uſe, who eſteems it an excellent cordial: and not only the camphire of *baros*, but alſo the oil of camphire, which is extracted from the roots of the cinnamon-tree, is a very great cordial, if taken inwardly: It ſtrengthens the ſtomach, expels wind, and hath been found of great ſervice in arthritic and gouty diſorders; it is alſo a diuretic: the doſe is 10 or 12 drops upon a bit of ſugar, or in a proper vehicle. It is outwardly applied in all arthritic pains from cold and obſtructions; being rubbed on the affected part with a warm hand, it will preſently leſſen the pain, and by degrees take it off.

About 36 years ago M. *Nicolas Dumbſtdorff* at *Amſterdam* was ſo cruelly afflicted with arthritic pains, that he could have no reſt either night or day; and tho' he had the advice of ſeveral noted phyſicians, and tried a great many medicines, yet he could find no relief; till he was adviſed to cauſe anoint himſelf with the oil of cinnamon tree root. M. *Seba* anointed him himſelf, rubbing the oil on all the affected parts, with his hand warmed by holding it to an oven; and this he did twice every day for an hour together. And tho', when this cure

cure was firſt begun with the patient, his hands and feet were by the convulſions and the violence of the pain, contracted in ſuch a manner, that they grew quite crooked, and full of nodes; yet in a fortnight's time he became ſo much better, that he could ſleep well of nights, feeling neither pain nor cramps. In about ſix weeks time he could walk about his room; whereas before anointing, he was not able to ſtir either hand or foot. This anointing was continued for about three months, when the patient not only recover'd of that violent indiſpoſition, but continued free from the gout ever after, and liv'd about 15 years in a very good ſtate of health. And ſeveral other people in the ſaid patient's condition did the ſame with equal ſucceſs.

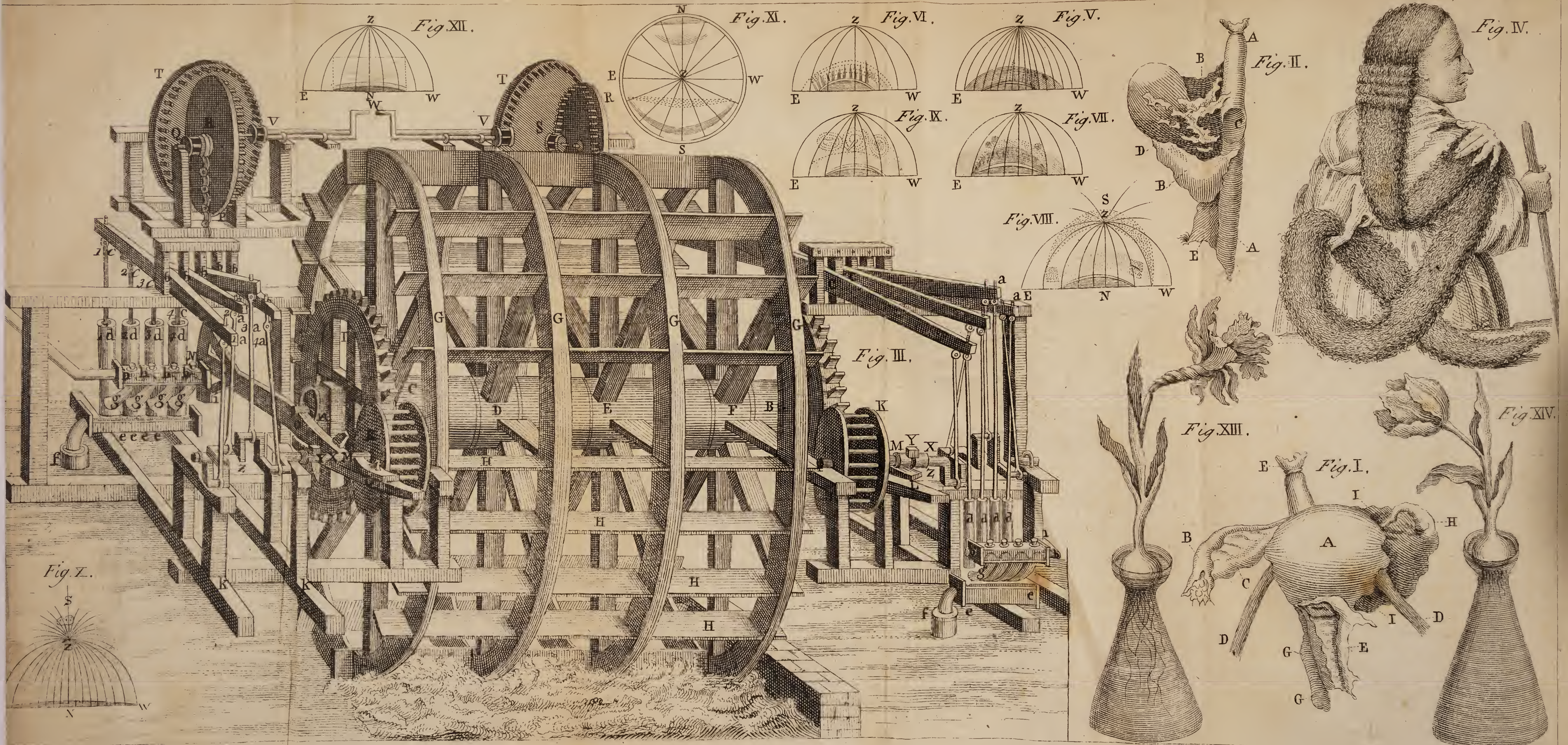
Several phyſicians have written largely of the virtues of common camphire, but there are ſtill many hidden qualities in this excellent medicine. Thus, for inſtance, M. *Seba* can affirm, that in all burnings by fire or otherwiſe, and the pains occaſioned thereby, he has not hitherto met with any better or ſurer medicine than the following.

℞ *Spir. lumbricor. terreſt. cum ſpir. vini rectificat.* ℥xii. *Camphor.* ℥ii. M.

No ſooner is a bandage, or compreſs, dipped into this ſpirit, applied to the affected part, but it will give inſtant relief; and ſo effectually check the inflammation, that it ſhall ſpread no farther. But the application of it muſt be continued till the pain be quite gone; and the *ulcus*, if any, dried up. If the exulceration be got deeper, and if the wound muſt be kept open, two ounces of camphire, diſſolv'd in *oleum hyperici*, mix'd with a pound of the common *unguentum ceruſſæ*, applied S. A. will quickly and effectually heal it, as M. *Seba* often experienced.

A Polypus, *reſembling a Branch of the* Pulmonary Vein, *cough'd up; by Dr.* Nichholls. Phil. Tranſ. N° 419. p. 123.

NICHOLAS *Tulpius* in *Obſ.* 7. *Book* 2. preſents us with the caſe of a man, who, with a large effuſion of blood, threw up, by coughing, two branches of the pulmonary vein, ſix inches long, with their ſeveral ramifications, freed from the *trachea* and ſubſtance of the lungs, as if very accu-



ith del. Hulett Sculp.

accurately diffected. This cafe he obferves to be very extraordinary, and not to be parallell'd in the writings of phyfical authors.

A fmall acquaintance with the ftructure of the lungs fufficiently evinces the impoffibility of the fact, as there ftated: Wherefore Dr. *Nicholls* (not doubting the author's veracity) always believ'd *Tulpius* was deceiv'd by a *polypus* of the vein, which might be cough'd up in the manner he defcribes it.

But the following cafe will put this matter in another light. *July* 18, 1730, Dr. *Nicholls* was confulted on behalf of one living in *Effex*, who was afthmatic, and cough'd up phlegm, refembling worms; to remedy which the Dr. directed a *lac ammoniacum*, with fquills; from the ufe of which he expectorated more eafily, but ftill continued to cough up the fame fubftances.

July 11, 1731. on the road to *London*, the patient was fiezed with a fhivering, and pleuretic pains; his tongue white, pulfe hard and quick, *&c.* By repeated bleeding his pains decreafed, but the cough continued, and that more violent than ufual. Upon examining the expectorated phlegm (which was tinged with blood) the Dr. found it fibrous, and (when expanded in water) exactly refembling the veffels in the lungs. Thefe fubftances are as tough as the coats of the veins, and like them hollow. The patient cough'd up more or lefs of them every day for feven years; fometimes perfectly white, and fometimes tinged with blood: Notwithftanding which, he has had no other complaint, has had a good appetite and colour, and a greater fhare of fat than any man would choofe. The fpecimen (reprefented Fig. 1. Plate VII.) was expectorated when the Dr. was prefent, namely *July* 16. 1731. It nearly refembles *Tulpius*'s firft draught; and is no more than a vifcid phlegm, fecreted by the relaxed glands of the *trachea*, and afterwards concreted by the heat of the part.

An Experiment, explaining a mechanical Paradox; namel[y] that two Bodies of equal Weight, suspended on a certai[n] sort of Balance, do not lose their Equilibrium, *by bein[g] remov'd, the one farther from, the other nearer to, th[e] Centre; by Dr.* Desaguliers. Phil. Transf. N° 41[..] p. 125.

PROP. 7, If the two weights P W (Fig. 2. Plate VIII hang at the ends of the balance A B, whose centre o[f] motion is C; those weights will act against each other (becau[se] their directions are contrary) with forces, made up of th[e] quantity of matter in each, multiplied by its velocity; tha[t] is, by the velocity which the motion of the balance turnin[g] about C will communicate to the body suspended. Now th[e] velocity of a heavy body is its perpendicular ascent or descen[t] as will appear by moving the balance into the position *a b* which shews the velocity of P to be the perpendicular lin[e] *e a*; and the velocity of B will be the perpendicular line *b g*. For, if the weights P and W be equal, and likewise the lin[es] *e a* and *b g*, their *momenta* made up of *e a*, multiplied in[to] W, and of *b g*, multiplied into P, will be equal, as wi[ll] appear by their destroying each other in making an *equilibrium*. But if the body W were remov'd to M, and suspende[d] at the point D; then its velocity being only *f d*, it would b[e] over-balanced by the body P; because *f d*, multiplied in[to] M, would produce a less *momentum* than P, multiplied in[to] *b g*.

As the arches A *a*, B *b*, and D *d*, described by the ends [of] the balance, or points of suspension, are proportionable [to] their sines *e a*, *g b*, and *d f*; as also the *radii* or distanc[es] C A, C B, and C D; in the case of this common sort [of] balance, the arches describ'd by the weights or their poin[ts] of suspension, or the distances from the centre, may be tak[en] for velocities of the weights hanging at A, B, or D; an[d] therefore the acting force of the weights will be reciproca[l] as their distances from the centre.

Scholium. The distances from the centre are taken he[re] for the velocities of the bodies, only because they are propo[r]tionable to the lines *e a*, *b g*, and *f d*, which are the tr[ue] velocities: For, there are a great many cases wherein th[e] velocities are neither proportionable to the distances from th[e] centre of motion of a machine, nor to the arches describ'd [by] the weights, or their points of suspension: Therefore, it [is] not a general rule, that weights act in proportion to their diſtances from the centre of motion; but a corollary of the general rule, namely, that weights act in proportion to their true velocities, which is only true in ſome caſes. Therefore, we muſt not take this caſe as a principle, which moſt workmen do, and all ſuch as make attempts to find the perpetual motion, as Dr. *Deſaguliers* has more amply ſhewn in *Phil. Tranſ.* N°. 369.

But to make this evident even in the balance, we need only take notice of the following experiment. A C B E K D (Fig. 3.) repreſents a balance in the form of a parallelogram paſſing thro' a ſlit in the upright piece N O, ſtanding on the pedeſtal M; ſo as to be moveable upon the centre pins C and K: To the upright pieces A D and B E of this balance are fixed at right angles the horizontal pieces F G and H I. That the equal weights P W muſt keep each other in *equilibrio* is evident; but it does not at firſt appear ſo plainly, that if W be remov'd to V, being ſuſpended at *6*, yet it ſhall ſtill keep P in *æquilibrio*, tho' the experiment ſhew it: Nay, if W be ſucceſſively moved to any of the points 1, 2, 3, E, 4, 5, or *6*, the *æquilibrium* will be continued; or if P (W hanging at any of thoſe points) be ſucceſſively moved to D, or any of the points of ſuſpenſion on the croſs-piece F G, it will at any of thoſe places make an *æquilibrium* with W. Now when the weights are at P and V, if the leaſt weight (that is capable of overcoming the friction at the points of ſuſpenſion C and K) be added to V as *u*; the weight V will overbalance, and that as much at V, as if it were at W.

From what has been ſaid above, the reaſon of this experiment will be very plain: As the lines A C and K D, C B and K E, always continue of the ſame length in any poſition of the machine; the pieces A D and B E will always continue parallel to each other, and perpendicular to the horizon: However the whole machine turns upon the points C and K, as appears by bringing the balance to any other poſition, as *abed*: And therefore as the weights, applied to any part of the pieces F G and H I, can only bring down the pieces A D and B E perpendicularly, in the ſame manner as if they were applied to the hooks D and E, or to X and Y, the centres of gravity of A D and B E; the force of the weights (if their quantity of matter be equal) will be equal; becauſe their velocities will be their perpendicular aſcent or deſcent, which will always be as the equal lines $4\,l$ and $4\,L$, wh ate ver part of the pieces FG and HI the weights are appli ed to: But if to the weight at V be added the little weight u, those two weights will overbalance; because in this case the *momentum* is made up of the sum of V and u, multiplied by the common velocity $4\,L$.

Hence it follows, that it is not the distance $c\,6$, multiplied into the weight V, that makes its *momentum*; but its perpendicular velocity $L\,4$ multiplied into its mass. Q. E. D.

This is still farther evident, by taking out the pin at K: For, then the weight P will over-balance the other weight at V; because then their perpendicular ascent and descent will not be equal.

A Vomiting of Blood *cured by drinking very cold Liquors in Winter; by Dr.* Michelotti. Phil. Transf. N° 419. p. 129. *Translated from the* Latin.

L*Udovicus Maffetti* after violent exercise by hunting and riding, would of a morning vomit up five or six ounces of blood; for which Dr. *Michelotti* used the following method of cure. As he perceiv'd the blood highly rarified, and its *impetus* upon the veins and arteries very considerable, which was greatly increas'd by a *plethora*; and as he was well aware, that the patient labour'd under a scirrhous spleen, on account of which he had for four years before vomited blood, and from his childhood been, every spring and autumn, subject to plentiful hemorrhages at the nose, which (after an accidental blow on the head at foot-ball) almost entirely ceased: Upon all these accounts the Dr. ordered to apply leeches immediately to the hemorrhoidal vessels, and drain off eight ounces of blood, both to diminish its quantity, and divert it from the spleen and stomach; and at several times that day, about a pint of plantain water, well saturated with nitre and coral, in order to allay the rarefaction of the blood. But about midnight his vomiting strongly recurring, he was instantly ordered four ounces of lettice water, mix'd up with 12 drops of *Helmont's Laudanum* with quinces, to diminish the velocity of the blood, and procure sleep; which when the patient had thrown up, with a plentiful discharge of blood at three or four times, recourse was had to pills made of six scruples of *Philonium persicum*, to be taken down with blood-wort water. At the same time he ordered the patient to hold in his mouth cold water, mixt with cold

vinegar,

vinegar, and to apply a ſponge, well ſoaked in cold vinegar, to the epigaſtric region, in order to conſtringe the blood-veſſels of the ſtomach, whether opened by eroſion, rupture or any other way; for which purpoſe, as the vomiting returned a fifth, and a ſixth time, and the patient ſeem'd to be quite ſpent, recourſe was had not only to a confection of the bruis'd ſeeds of white poppies and henbane with *ſaccharum roſaceum*, *bol. armen.* and *lap. hæmatit.* to be taken in about a drachm at a time, but likewiſe to *Helvetius*'s conſolidating pills, three ſcruples of which were taken every four hours in the water juſt mentioned, in which a ſmall quantity of the powder of pearls and red coral calcined, as alſo of the magiſtery of crabs-eyes was diſſolv'd. By theſe means the vomiting ceas'd for ſome hours.

The Dr. forbore opening a vein that night; and that, becauſe he found the patient had vomited upwards of 12 pounds of blood in about two hours time, and that he lay in a cool room, and with few bed-cloaths on; as alſo becauſe the contraction of the heart and arteries, and conſequently, the velocity of the ſmall remaining quantity of blood would be very conſiderable; and again that the letting of a ſmall quantity of blood either in a part nearer to, or at a greater diſtance from the ſtomach would not be ſufficient to divert its courſe; and in the next place, becauſe he ſaw that by opening a vein in ſuch circumſtances, the proportion of the ſulphureous particles of the maſs of blood might be encreaſed, being remarkably ſo already, as the Dr. conjectured by the patient's great thirſt, heat of his body, toſſing of his arms and legs, and the remarkable frequency of his pulſe, which, together with an encreaſed velocity of the blood, might again bring on the vomiting.

Next morning about day-break, the vomiting was conſiderable; for which the patient drank four ounces of cold nettle water mixt with eight grains of toaſted *opium*; which not entirely ſucceeding, he at length concluded to compreſs the blood veſſels reaching into the cavity of the ſtomach by condenſing its air, and to repel their blood by means of cold potions; but becauſe the patient was ſo much exhauſted, and his ſtomach ſo exceedingly weaken'd, that he threw up the lighteſt food, as panada, yolks of eggs diſſolv'd in chicken broth, ptiſans or rice-milk, he was ordered light and ſtrengthening ſippings; as of *chioccolatte*, cows milk and ſugar, cremor of ſweet almonds, and white poppy-ſeeds, newly ex-

preſs'd

preſs'd with ſugar: About ſeven ounces of theſe liquors, congeal'd with ice and nitre, were every five or ſix hours given the patient; ſometimes one ſort, and ſometimes another; with a few draughts of the cold *Nucerine* water, and this method contributing greatly, and in a ſurpriſing manner, to the cure, he perſiſted in it almoſt to the beginning of the enſuing *February*; at which time he ordered for the firſt days rice boiled in cock-broth, or wheaten bread well ſoaked in the ſame broth, or in a freſh egg; and the following days meat, as ſometimes fowl, veal, and ſmall birds: And beſides to ſtrengthen the patient's weak ſtomach, about 60 drops of the tincture of wormwood, extracted without ſpirit of wine, were to be taken every day before dinner in a ſpoonful of pimpernel water.

On the third or fourth day of the patient's illneſs, the Dr. ordered clyſters of cow's milk, mixt up with butter, the yolk of an egg, and brown ſugar, in order to bring away that black ſooty blood flowing from the ſtomach to the lower parts; and on that account he judged it better to abſtain from ſuch medicines, commonly preſcrib'd by other phyſicians in vomitings of blood, as either hinder or remove its concretion, effects entirely oppoſite to thoſe of cold liquors, by which a cure was already ſo ſucceſsfully begun.

And by this method of cure, the patient, brought to the loweſt paſs, was freed from a very dangerous diſorder, as we have ſeen above. And to prevent any future relapſe, the Dr. ordered every three or four months to take away ſeven or eight ounces of blood, for the moſt part from the arms, and and ſometimes from the hemorrhoidal veſſels. The reaſon of this precaution was, that the ſpleen being ſcirrhous, as above-mentioned, its blood-veſſels could not poſſibly contain their natural quantity of blood, and therefore the other veſſels of the body, and more ſo, thoſe of the ſtomach, which lies ſo near the ſpleen, muſt neceſſarily contain more than their natural quantity; and on that account be ſo dilated, as to give paſſage to the blood that continually endeavours to eſcape from them; as is commonly the caſe in ſpitting or vomiting of blood, or in hemorrhages at the noſe from great obſtructions in the veſſels of the lower belly; as we have inſtances in *Riolanus*; who from *Hippocrates* and *Valverda* gives hiſtories of ſuch as died by vomiting blood, from a turgid ſpleen: Therefore, by way of prevention, he judged it proper to uſe repeated bleeding; and becauſe the *impetus* of the blood upon the veſſels may be encreaſed creafed by an increafe of velocity, the patient was to drink cold water inftead of wine, and to abftain from hunting, running, and other violent exercifes, that might accelerate the motion of the blood; and this method was attended with good fuccefs till *December* 1730: On the 2d of *December*, in the night he had a relapfe; but fince he vomited only a pound, or two, and the Dr. obferved a fullnefs of good blood; tho' the vomiting continued, and the arteries were almoft entirely flaccid, yet he was immediately order'd blooding in the left arm, to the quantity of 10 ounces, in order to divert its courfe from the blood-veffels of the ftomach; and after that, 15 or 18 drops of *Helmont*'s liquid *laudanum* in 4 ounces of the water of the leffer pimpernel, both to procure fleep and retard the velocity of the blood; and he was obliged to repeat the dofe 3 or 4 times that evening; becaufe the patient had thrown it up upon the return of the vomiting.

By thefe means the vomiting had fcarce intermitted for 2 hours; but upon its returning once and again, the Dr. likewife order'd to draw about 4 ounces from the hemorrhoidal veffels; and at the fame time he had recourfe to cold liquors, which at other times he had found fuccefsful, and which at that very time fucceeded fo well with a young woman, who was almoft exhaufted by profufe vomiting of blood from obftructions in the veffels of the *uterus*; and firft he had recourfe to *Chioccolatte*, and about 4 hours after to other congealed liquors, fuch as *forbetti di fpumiglia & pappina*, as they are called. By this method of cure, by which the motion of the blood, efpecially in the gaftric arteries and veins, might be check'd, the vomiting ceas'd till next day; when returning twice, it was again ftopped by repeating the faid cold liquors, every third or fourth hour.

On the 3d day of the diforder, the Dr. upon the patient's vomiting again in a fmall quantity about evening, prefcribed gilded pills *Philon. perfic.* 30 *gr. toft. opij* ℈*fs.* in 3 ounces of tormentil water, in order to procure fleep, and lay the preternatural commotions of the heart and arteries; which anfwer'd fo well, that the vomiting immediately ceafed, and the patient flept pretty well in the night. While thefe things were taken in by the mouth; clyfters, made of milk, butter, fugar and yolks of eggs, mixt up together, were thrown up by the *anus*, on the 2d and 3d day, to bring away the black blood, that had now fallen down from the ftomach into the guts, under the appearance of black bile: Befides, he was ordered to drink often

and

and in ſmall quantities, for fear of cloying the ſtomach, milfoil water, wherein a quince had boiled a little, and which was cooled with ice; to brace up the ſtomach and ſtrengthen its blood-veſſels, and aſſwage the patient's thirſt, which began to urge the third day.

For 12 days together this cold and thin diet was ſucceſsfully uſed, and under it the patient broke wind plentifully downwards; after which time, complaining very much of a diſtending pain in his ſtomach (becauſe he had drank to exceſs of the ſaid water, cool'd with ice, in order to allay his thirſt) the Dr. forbore the uſe of it, and ſubſtituted a ſomewhat fuller diet; as warm chicken-broth, in which the yolk of a freſh egg was diſſolved with ſome lemon juice. Theſe broths were taken twice a day, with ſome hot *Chioccolatte* early in the morning, but firſt a draught of cold water, broth to cool the ſtomach, and allay the patient's immoderate thirſt, was drank. Againſt the troubleſome diſtenſion of the ſtomach, beſides the hot liquors, the pills juſt mentioned were given, for compoſing the immoderate commotions of the nerves and animal ſpirits.

On the 14th day, after a ſlight head-ach on the days immediately preceeding, there ſuddenly aroſe a pain and tumour ſpreading wide behind the left ear about the middle of the lower mandible, and at the ſame time a continent but ſlight fever, with a ſhuddering, is intended, with ſome degree of a *delirium*. For this pain the Dr. preſcribed warm and moiſt fomentations, to be applied with ſponges, and made of equal parts of cow's milk and ſimple water, in which alder flowers were boiled; and by this, the matter of the tumour was almoſt entirely diſcuſs'd in 8 days; after which time, the fever, intending a little about night, and remitting in the morning, ſtill continued; the patient was not now ſo thirſty; drank the cold *Nucerine* waters; was awake in the day time, and ſlept in the night; was refreſh'd by the warm liquors abovementioned; and ſometimes he made uſe of a rice-ptiſan. He was naturally and even in health troubled with belchings; and ſometimes he complained of acids (as he ſaid) which irritated his ſtomach, ſo that he threw up phlegm, and ſometimes his aliments; for which the Dr. gave once a day about noon (not without ſucceſs) the tincture of wormwood, and frequently the cold *Nucerine* waters; and ſometimes the *philonium perſicum* and toaſted opium, and ſometimes cold potions of milk and ſugar, congeal'd by art for his belching; and he ordered warm fomentations to allay the commotions in his ſtomach.

About

About the 40th day the patient difcharged by the mouth a watery humour; his arteries were in a natural ftate; his ftools were daily in fufficient quantity; and he made water plentifully; and his ftrength and appetite increas'd in fuch manner, that the Dr. was obliged to give thrice a day, fome ftronger food, as cold jellies of hart's-horn and calves feet, and that a little before he took the above-mentioned nourifhing broths.

From fuch kind of food he firft made a tranfition to rice, boiled in capon-broth, and to boiled pullets livers; and afterwards to tender fowl, veal and quails; and in order to keep an open belly he took about a fpoonful or two of cows milk, the white of a frefh egg, mixt up with a very little fugar: And now he is well and in perfect health.

It is no difficult matter to demonftrate that this method of cure, by the above-mentioned congealed liquors, is founded on very folid reafons. For, firft the blood-veffels of the ftomach, pouring their contents into its cavity, either by the rupture, erofion or thinnefs of their coats, or by the opening of their orifices, and being immediately in contact with, and pincht by thofe congealed liquors, are inftantaneoufly and ftrongly corrugated; and then the blood contained in thefe veffels is forcibly infpiffated, and repelled into the larger canals; and the body fhuddering all over by the exceffive cold, the reft of the blood is greatly retarded in its motion; and confequently, that *impetus*, by which the extremities of the veins and arteries might be opened, and which arifes from the velocity of the pulfe of the heart and arteries, is confiderably diminifhed; and again, thefe exceeding cold liquors, made up of nutritive *moleculæ*, and flowing into the blood, and collected there, do without any *impetus* recruit the remaining mafs.

Bartholin in his little treatife *de ufu nivis medico*, not only quotes *Abenfina*, but likewife *Galen*, as prefcribing liquors, cooled with fnow, for hot diforders of the ftomach: And probably, the latter, according to *Bartholin*, follows *Seneca* in his *Nat. Quæft.* and propofes to cure the diforders of the ftomach, with water, food and fruit, cooled with fnow, *Met. Med. lib.* 7. *cap.* 4.

Befides *Abenfina* and *Galen*, the fame *Bartholin* likewife quotes *Rhafes*, *Zacutus*, and *Amatus*, both *Portuguefe*, *Lud. Septalius*, *Laz. Riverius*, and others, who, to cool the exceffive heat of the ftomach, and cure colics, arifing from hot and bilious humours, prefcribed food and drink, cooled with ice, and applied to the belly linnen-cloths dipt in cold water. But he mentions no one, who had ever cur'd vomiting or fluxes of

 blood

blood in any part of the body, by potions cool'd with ſnow or ice, or any other kind of cold liquors.

That liquors cool'd with an emulſion of melon-ſeeds and a little ſugar, when given ſparingly about the evening, have pretty good effects, the Dr. experienced in very cold weather, in a young nun of a hot conſtitution, grievouſly affected with a *ſpaſmus* of the ſtomach, from exceſſive grief, which conſtringed its left orifice in ſuch manner, that ſhe reſpired with difficulty, and the deſcent both of her food and drink, tho' in ſmall quantities, was almoſt entirely precluded.

Tho' *Hippocrates, Sect.* 5. *Aphor* 24. writes *frigida, veluti nivem & glaciem, ſanguinis eruptiones inducere:* Yet *Aphor.* 23. he aſſerts; *in his frigidâ uti oportere, unde ſanguis eruptus, aut erupturus eſt, & quidem circa ipſas partes, unde fluit.* About 6 years before, after a fruitleſs uſe of the common medicines, and even very cold water, Dr. *Michelotti*, in the middle of ſummer, very readily ſuppreſſed a large flux of blood from the *uterus*, by laying ice upon the knees and thighs; whereby the crural, and conſequently, the *iliac*, and other arteries and veins, terminating in the *uterus*, were conſtringed, the blood for that reaſon repreſs'd, and precluded, as it were, its uſual courſe.

Tho' the Dr. very much approve of cold liquors in all fluxes of blood, eſpecially from the ſtomach, and which are owing to an efferveſcence and accelerated motion of the blood, or accompanied with them, and eſpecially in young people, whoſe blood and ſtomach are in a ferment: Yet he would not preſcribe theſe congealed liquors indiſcriminately to women, that vomit blood after child-birth, or that are ſubject to cold fermentations of the ſtomach, or inteſtines: In this caſe, as he would neither ſo readily uſe a deal of warm water; nor ſuch as is lukewarm, as *Hippocrates* indiſcriminately preſcribes both in his treatiſe *de Morb. Muliebr.* and in that *de Nat. Muliebr.* ſo neither would he condemn aſſes or cows milk, which the ſame *Hippocrates* preſcribes in theſe caſes. In blood-vomiting from a ſuppreſſion or diminution of the *lochia*, he would preſcribe in the firſt place to open a vein in the feet in order to divert the blood from the ſtomach; and warm fomentations of water and white wine, in which emollient and aperient herbs were boiled, on the hypogaſtric region; and at the ſame time to waſh the legs and feet in a large quantity of warm water, that the veſſels of the *uterus* might be opened; and then he would have recourſe to milk, in order to moiſten and recruit the maſs of blood. But ſhould a woman at the ſame time vomit blood and have her *Lochia*, the

Dr.

Dr. would, by carefully attending to every particular circumſtance, endeavour to ſuppreſs the vomiting, not with warm fomentations and lotions, but with remedies that allay the *impetus* of the blood, that inſpiſſate it and moderate its heat; and that ſtrengthen the veſſels of the ſtomach: And when the vomiting was ſuppreſſed, he would have recourſe to a milk-diet; or if that ſhould prove ineffectual, to ſtrengthning draughts of *chioccolatte*, and nouriſhing broths, made of chickens, frogs, ſnails, &c.

The Deſcription of an Inſtrument for taking Angles, *by reflections, invented by Mr.* Hadley. Phil. Tranſ. N° 420. p. 147.

THIS inſtrument is deſign'd to be of uſe, where the motion of the objects, or any circumſtance, occaſioning an unſteadineſs in the common inſtruments, renders the obſervations difficult or uncertain.

The contrivance of it is founded on this obvious principle in catoptrics; namely that if the rays diverging from, or converging to any point, be reflected by a plane poliſh'd ſurface, they will, after the reflection, diverge from, or converge to another point on the oppoſite ſide of that ſurface, at the ſame diſtance from it as the firſt; and that a line perpendicular to the ſurface, paſſing thro' one of thoſe points, will paſs thro' both. Hence it follows, that if the rays of light, emitted from any point of an object, be ſucceſſively reflected from 2 ſuch poliſh'd ſurfaces; that then a third plane, perpendicular to them both, paſſing thro' the emitting point, will alſo paſs thro' each of its 2 ſucceſſive images, made by the reflections: All the 3 points will be at equal diſtances from the common interſection of the 3 planes; and if 2 lines be drawn thro' that common interſection; one from the original point in the object, the other from that image of it which is made by the ſecond reflection, they will form an angle double to that of the inclination of the two poliſh'd ſurfaces.

Let RFH and RGI (Fig. 4. Plate VII.) repreſent the ſections of the plane of the figure by the poliſh'd ſurfaces of the 2 *ſpecula* BC and DE, erected perpendicularly thereon, meeting in R, which will be the point where their common ſection, perpendicular likewiſe to the ſame plane, paſſes it, and HRI is the angle of their inclination. Let AF be a ray of light from any point of an object A falling on the point F of the firſt *ſpeculum* BC, and thence reflected into the line FG; and at the point G of the ſecond *ſpeculum* DE reflected again into the line GK; produce GF and KG backwards to M and N, the 2 ſucceſſive repreſentations of the point A; and draw RA, RM, and RN.

Since the point A is in the plane of the ſcheme, the point M will be ſo too by the known laws of catoptrics. The line FM is equal to FA, and the angle MFA double the angle HFA, or MFH; conſequently RM is equal to RA, and the angle MRA double the angle HRA, or MRH. In the ſame manner the point N is alſo in the plane of the ſcheme, the line RN equal to RM, and the angle MRN double the angle MRI or IRN: Subſtract the angle MRA from the angle MRN, and the angle ARN remains equal to double the difference of the angles MRI and MRH, or double the angle HRI, by which the ſurface of the *ſpeculum* DE is reclined from that of BC; and the lines RA, RM and RN are equal.

Corollary 1. The image N will continue in the ſame point; tho' the 2 *ſpecula* be turned together circularly on the axis R, ſo long as the point A remains elevated on the ſurface of BC; provided they retain the ſame inclination.

Cor. 2. If the eye be placed at L (the point where the line AF continued cuts the line GK) the points A and N will appear to it at the angular diſtance ALN, which will be equal to ARN: For, the angle ALN is the difference of the angles FGN and GFL, and FGN is double FGI; and GFL double GFR; and conſequently their difference double FRG or HRI: Therefore, L is in the circumference of a circle, paſſing thro' A, N and R.

Cor. 3. If the diſtance AR be infinite, thoſe points A and N will appear at the ſame angular diſtance, in whatever points of the ſcheme the eye and *ſpecula* are placed: Provided the inclination of their ſurfaces remain unalter'd, and their common ſection parallel to itſelf.

Cor. 4. All the parts of any objects will appear to an eye viewing them by the 2 ſucceſſive reflections, as before deſcribed, in the ſame ſituation as if they had been turned together circularly round the axis R, keeping their reſpective diſtances from one another and the axis, with the direction HI, *i. e.* the ſame way the ſecond *ſpeculum* DE reclines from the firſt BC.

Cor. 5. If the *ſpecula* be ſuppos'd to be at the centre of an infinite ſphere; objects in the circumference of a great circle, to which their common ſection is perpendicular, will appear remov'd by the 2 reflections, thro' an arch of that circle, equal to

twice

twice the inclination of the *ſpecula*, as is ſaid before: But objects at a diſtance from that circle will appear remov'd thro' the ſimilar arch of a parallel: Therefore, the change of their apparent place will be meaſur'd by an arch of a great circle, whoſe chord is to the chord of the arch, equal to double the inclination of the *ſpecula*, as the co-ſines of their reſpective diſtances from that circle are to the radius: And if thoſe diſtances be very ſmall, the difference between the apparent tranſlation of any one of theſe objects, and the tranſlation of thoſe which are in the circumference of the great circle aforeſaid, will be to an arch, equal to the verſed ſine of the diſtance of this object from that circle, nearly, as double the ſine of the angle of inclination of the *ſpecula*, is to the ſine complement of the ſame.

A B C (Fig. 5.) repreſents the inſtrument, which conſiſts of an octant, having on its limb B C an arch of 45 degrees, divided into 90 parts or half degrees; each of which anſwers to a whole degree in the obſervation: It has an index M L moveable round the centre, to mark the diviſions; and upon this near the centre is fixed a plane *ſpeculum* EF perpendicular to the plane of the inſtrument, and forming ſuch an angle with a line drawn along the middle of the index, as ſhall be moſt convenient for the particular uſes the inſtrument is deſign'd for (for an inſtrument, made according to that repreſented in the figure, the angle L M F may be of about 65 degrees) I K G H is another ſmaller plane *ſpeculum*, fixed on ſuch part of the octant, as will likewiſe be determined by its particular uſe, and having its ſurface in ſuch direction, that when the index is brought to mark the beginning of the diviſions (*i. e.* o degrees) it may be exactly parallel to that of the other; this *ſpeculum* being turned towards the obſerver, and the other from him. P R is a teleſcope fixed on one ſide of the octant, having its axis parallel to that ſide, and paſſing near the middle of one of the edges I K or I H of the *ſpeculum* I K G H: So that half its object glaſs may receive the rays reflected from that *ſpeculum*, and the other half remain clear to receive them from a diſtant object. The two *ſpecula* muſt likewiſe be diſpos'd in ſuch manner, that a ray of light coming from a point near the middle of the firſt *ſpeculum*, may fall on the middle of the ſecond in an angle of 70 degrees, or thereabouts; and be thence reflected into a line parallel to the axis of the teleſcope; and that a clear paſſage be left for the rays coming from the object to the

the *speculum* EF, by the side HG. ST is a dark glass, fixt in a frame, which turns on the pin V, by which means it may be placed before the *speculum* EF, when the light of one of the objects is too strong: Of these there may be several.

In the distinct base of the telescope, represented (Fig. 6.) by the circle *abcdef*, are placed three hairs; two of which *ac* and *bd* are at equal distances from, and parallel to the line *gh*, which passes thro' the axis, and is parallel to the plane of the octant; the third hair *fc* is perpendicular to *gh* passing thro' the axis.

The instrument, as thus described, will serve to take any angle not greater than 90 degrees: But if it be designed for angles from 90 to 180 degrees, the polish'd surface of the *speculum* EF (in Fig. 5.) must be turned towards the observer; the second IKGH must be brought forward to the position NO; so as to receive on its middle the rays of light from the middle of the first *speculum* in an angle of about 25 degrees, their surfaces being perpendicular to one another, when the index is brought to the end of the divided arch next C: and this second *speculum* must stand five or six inches wide of the first; that the observer's head may not intercept the rays in their passage towards it, when the angle to be observ'd is near 180°. The smaller *speculum* is fixt perpendicularly on a round brass plate, tooth'd on the edge; and may be adjusted by an endless screw.

In order to make an observation, the axis of the telescope is to be directed towards one of the objects, the plane of the instrument passing as near as possible thro' the other, which must lie to that hand of the observer, as the particular form of the instrument may require, *viz.* the same way that the *speculum* EF does from IKGH, if it be made according to this figure and description. The observer's eye being applied to the telescope, so as to keep sight of the first object; the index must be mov'd backward and forward, till the second object be likewise brought to appear thro' the telescope, about the same distance from the hair *cf* (Fig. 6.) as the first: If then the objects appear wide of one another, as at *i* and *k*; the instrument must be turned a little on the axis of the telescope, till they come even, or very nearly so; and the index must be remov'd till they unite in one, or appear close to one another, in a line parallel to *cf*; both of them being kept as near the line *gh* as possible. If the instrument be then turned a little on any axis perpendicular to its plane, the two images will move along a line, parallel to *gh*, but

keep

keep the same position in respect of each other: So that in whatever part of that line they be observ'd, the accuracy of the observation will be no otherwise affected than by the undistinctness of the objects. If the 2 objects be not in the plane of the instrument, but equally elevated on, or depress'd below it, they will appear together at a distance from the line *g h*, when the index marks an angle something greater than their nearest distance in a great circle: And the error of the observation will increase nearly in proportion to the square of their distance from that line, but may be corrected by help of the 5th *Corol.* Suppose the hairs *a e* and *b d*, each at a distance from the line *g h*, equal to $4\frac{100}{146}$ of the focal length of the object-glass; so as to comprehend between them the image of an object, whose breadth to the naked eye is a little more than $2^\circ \frac{3}{4}$; and let the images of the objects appear united at either of those hairs: Then as the sine complement of half the degrees and minutes, mark'd by the index: is to the doubled sine of the same:: So is one minute: to the error which is always to be substracted from the observation. Other hairs may likewise be placed in the area *a b c d e f*, parallel to *g h*, and at distances from it proportional to the square roots of the numbers 1, 2, 3, 4, &c. And then the errors to be substracted from the same observation, made at each of those hairs respectively, will be in proportion to the numbers 1, 2, 3, 4, &c. This correction will always be exact enough, if the observer take care (especially, when the angle comes near 180°) to keep the plane of the instrument from varying too much from the great circle passing thro' the objects.

In regard to the workmanship, if an exactness be required in the observations, the arch ought to be divided with the greatest care; because all errors committed in the division are doubled by the reflections: The index must have a steady motion on the center; so that its axis remain always perpendicular to the plane of the octant: For, if that alter, it will be liable to vary the inclination of the *speculum* it carries to the other: The motion must likewise be easy, lest the index be subject to bend edgeways: For the same reason it should be as broad at that end next the centre as conveniently can be: The *specula* should have their surfaces of a true flat; because a curvature in either of them, besides rendering the object indistinct, will vary its position, when seen by reflection from different parts of them: They must also be of a sufficient length and breadth for the telescope to take in a convenient angle without losing the use of any part of the aperture of its object glass, and that in all the different positions

positions of the index. They may be either of metal or glaſs plates foil'd, having their two ſurfaces as nearly parallel as poſſible; yet a ſmall deviation may be allow'd; provided either the thickeſt or thinneſt (and conſequently, the common ſection of their ſurfaces) be parallel to the plane of the octant: For, in that caſe, tho' there be ſeveral repreſentations of the object, they will be always very near one another, in a line parallel to *c f*; and any of them may be uſed, except when the angle to be obſerv'd is very ſmall. The chief inconvenience will be, that a ſmall ſtar will be more difficultly diſcerned, the light being divided among the ſeveral images. The teleſcope may be contriv'd to alter its ſituation; ſo as to receive the reflected rays on a greater or leſs part of its object glaſs, if the objects differ in brightneſs. The ſecond *ſpeculum* may have a part unfoil'd, that if either of them be ſufficiently luminous, the leſs bright may be ſeen thro' it by the whole aperture. If the ſun be one of the objects, or the moon be compared with a ſmaller fixt ſtar; their reflected images muſt be ſtill farther weakened, by the interpoſition of one or more of the dark glaſſes S T. An exact poſition of the teleſcope is not neceſſary; and the inſtrument may be us'd without one, the diſpoſition of the *ſpecula*, with regard to the ſector and index, being ſuch as may allow the eye to be brought as near the ſecond *ſpeculum* as may be, and make the inſtrument the moſt commodious for the obſerver. No greater degree of ſteadineſs is requiſite in a pedeſtal, or machine which carries this inſtrument, than what is ſufficient for the teleſcope us'd with it: For, tho' the vibrating motion of the inſtrument may alſo occaſion the images of the objects to vibrate croſs one another; their apparent relative motion will be very nearly in lines parallel to *c f*; and it will not be difficult to diſtinguiſh whether they coincide in croſſing one another, or paſs at a diſtance: And if the objects are near one another, and the teleſcope magnify but about four or five times, it may be held in the hand without any ſtanding ſupport. In this manner the altitude of the ſun, moon, or ſome of the brighter ſtars from the viſible horizon, may be taken at ſea, when it is not too rough.

Fig. 7. ſhews an inſtrument deſigned for this purpoſe; differing from the foregoing deſcription chiefly in placing the *ſpecula* and teleſcope, with regard to the ſector and index; it has alſo a third *ſpeculum* N O diſpos'd according to the directions when the angle is greater than 90°, whoſe uſe is to obſerve the ſun's altitude by means of the oppoſite part of the

the horizon. In placing theſe two ſmaller *ſpecula*, it will be farther neceſſary to take care that the *ſpeculum* I K G H do not ſtand ſo as to intercept any of the rays coming from the greater one, fixt on the index, to the third N O; nor either of them hinder the index from coming home to the end of the divided arch. W Q is a direction for the ſight; which is neceſſary when the teleſcope is not made uſe of. This conſiſts of a long narrow piece, which ſlides on another fixt on the back of the octant, and carries at each end a ſight erected perpendicularly on it: It may be remov'd at pleaſure, and exchanged for the teleſcope, which ſlides on in the ſame manner, both ſerving indifferently with either of the two ſmaller *ſpecula*. The eye is to be placed cloſe behind the ſight at W; and the thread, ſtretcht acroſs the opening of the other ſight at Q, perpendicular to the inſtrument, is to aſſiſt the obſerver in holding it in a vertical poſition, who is to keep this thread as near as he can parallel to the horizon, and the object near the upright one.

How far an inſtrument of this kind may be of uſe at ſea to take the diſtance of the moon's limb from the ſun or a ſtar, in order to find the ſhip's longitude, when the theory of that planet is perfect, Mr. *Hadley* leaves to trials to determine.

The theory of the moon has already been brought to a good degree of certainty and exactneſs thro' the conſummate ſkill of one of the members of the *Royal Society*, namely Sir *Iſaac Newton*, and there is great reaſon to hope, it will in a little time appear to be compleated by the continued application of ſome of that body.

An Account of the Stylus *of the Ancients, and their different ſorts of* Paper; *by Sir* John Clerk. Phil. Tranſ. N° 419. p. 157.

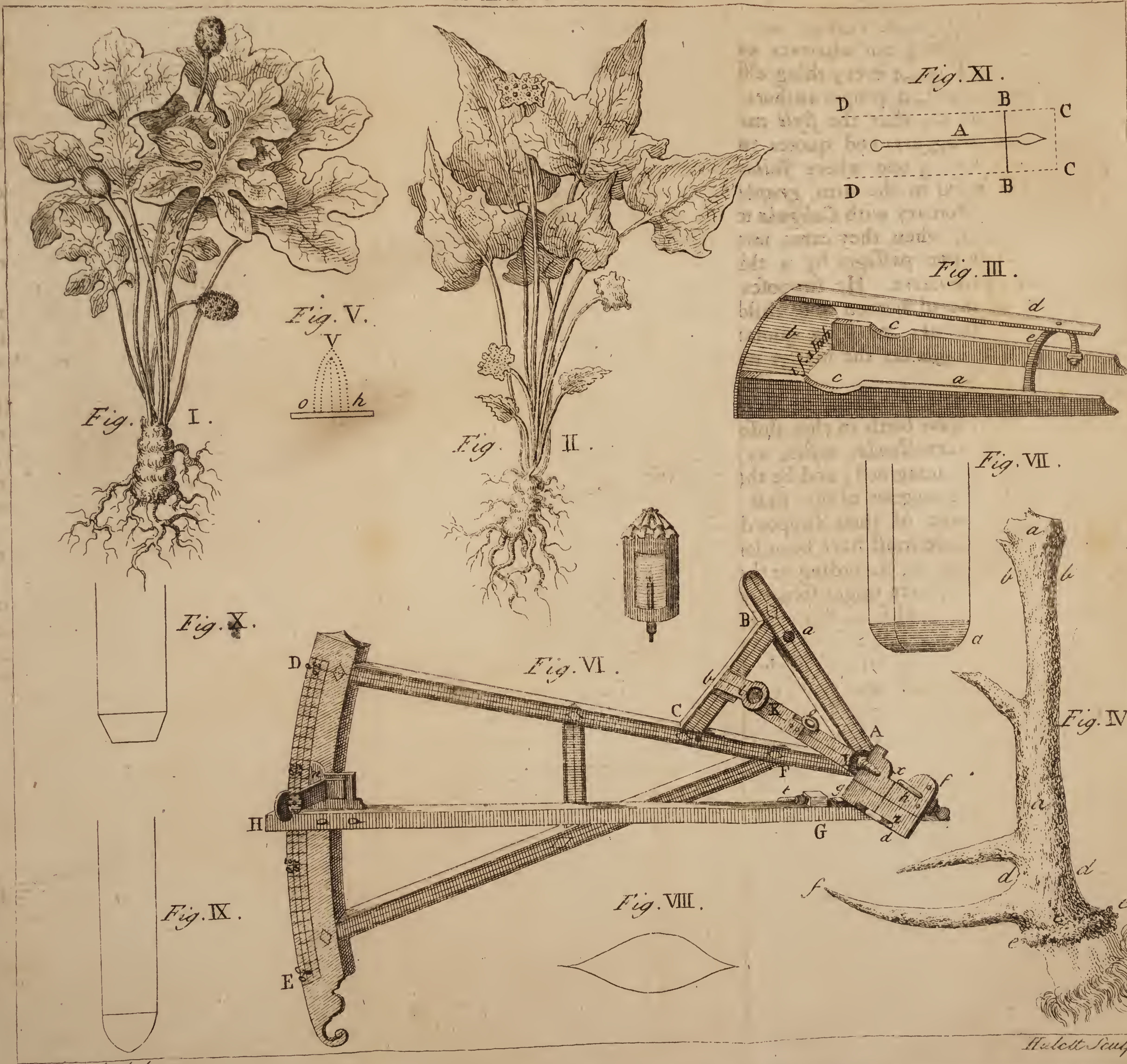
SIR *John Clerk* takes occaſion from ſome antique braſs implements found near the wall of *Antoninus Pius* (now call'd *Graham*'s *Dyke*, in *Scotland)* to give us this curious diſſertation on the *ſtylus* (an inſtrument us'd by the ancients for writing) together with the figures of ſome of them; two of which are repreſented in the ſhape and form of the *Roman fibula*; but he is of opinion they were deſigned for a different purpoſe, for which he produced very cogent reaſons.

He obſerves, that before the uſe of pens the ancients perform'd their writing with an inſtrument, call'd a *ſtylus* or *graphium*. The matter of it was gold, ſilver, braſs, iron or bone; the ſhape various, but alike in being pointed and ſharp at one end, and flat and broad at the other: The firſt for writing, or rather cutting their letters; the latter for defacing or rubbing out whatever wanted correction; for all which, as well as for every thing elſe he aſſerts, he adduces ſufficient proofs from proper authors.

He informs us, that the *ſtyli* made of iron, were ſometimes us'd as daggers, and quotes two paſſages out of *Suetonius* to prove it; one where *Julius Cæſar* is ſaid to have wounded *Caſſius* in the arm, *graphio*; the other where he tells it was cuſtomary with *Caligula* to get his enemies murder'd, *graphiis*, when they came into the ſenate-houſe; and confirms theſe two paſſages by a third, taken from *Seneca*'s firſt book *de clementia.* He ſuppoſes the *ſtylus* made of bone was for the uſe of women and children, as leſs dangerous than thoſe of metal; and by a quotation from *Prudentius* it appears, that *Caſſianus* the martyr was kill'd by his ſcholars with iron *ſtyli*.

He agrees with *Petavius*, or his editors, that the implements, which gave birth to this diſſertation, were *ſtyli*, and not *fibulæ ad connectendas veſtes*, as *Montfaucon* and other antiquaries have imagined; and he thinks, that the objection, namely that the tongues of the *ſtyli* muſt have been much longer than thoſe of their ſuppos'd *fibulæ*, to be of little weight; ſince there muſt have been ſome of them longer, and ſome of them ſhorter, according to the different fancies of the writers: Military men might ſometimes write with the point of their daggers; and from this practice the words *ſtylus* and *pugio* come to be confounded: But men of buſineſs and private perſons cannot be ſuppos'd to have made uſe of daggers for writing. He alſo obſerves (which is no ſmall argument for his ſide of the queſtion) that if *Montfaucon* had conſulted the numerous draughts he has publiſhed of the habits of the old *Greeks* and *Romans*, he would not have found one of theſe implements, either as a faſtening, or an ornament upon them.

He proceeds next to a deſcription of thoſe *ſtyli* found in *Scotland*; and ſhews how they were accommodated to the buſineſs he ſuppoſes them deſign'd for: But as the copperplate prefixt to his diſſertation will give a much clearer notion of that, the reader is referr'd to it; only it is to be taken notice that the fifth figure in it is entirely different from the others, that he himſelf is in ſome doubt



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about it; and owns it might have ferv'd the *arifpices*, in examining the bowels of animals, and have been one of thofe inftruments call'd *extifpicia*: However, he thinks that if he fhould pronounce it to have been a *ftylus*, he fhould not have been much out of the way; fince the ancients had their *thecæ graphiariæ*, which name will agree very well with this brafs cafe, and the inftrument found within it. From the *ftylus*, ufed to form letters, comes that figurative expreffion, that a perfon writes fuch or fuch a fort of a ftyle, to denote his manner, as a lofty ftyle, or a low ftyle; which way of fpeaking our own and other modern nations have introduc'd into their language.

As to the feveral forts of *charta* us'd for writing, he obferves the moft ancient were made of barks of trees, or fkins; or were fuch as are call'd *pugillares*. The oldeft were of the inner barks of trees, call'd *liber* in *Latin*; whence a book had the name of *liber*; but very little of this fort is now in being, unlefs the *Egyptian* paper may be accounted one fpecies of it.

The *papyrus* was call'd Βυϐλος or Βιϐλος by the *Greeks*, and thence their books were call'd Βιϐλοι or Βιϐλια. This fort of *charta* was made of a plant, that had feveral pelliceous tunicles, as *Pliny* informs us, which were feparated from one another by a needle; and then glued again together, to give them a ftrength and firmnefs fufficient to retain what might be written upon them. *Alexandria* was the place moft eminent for this manufacture. There are fome fragments of this fort ftill extant in libraries, particularly the famous manufcript of St. *Mark*'s gofpel at *Venice*.

The *chartæ membranaceæ* are made of the fkins of animals, drefs'd either like our glove leather, or modern parchment. The firft fort was commonly ufed by the *Jews* for writing the law of *Mofes* upon it; and from the rolling up of thefe fkins comes the word *volumen*. But the fkins which *Varro* and *Pliny* fay were firft made by *Eumenes* King of *Pergamus* were in more common ufe: However, *Eumenes*, who, as thefe authors relate, made them in oppofition to *Ptolemy*, King of *Egypt*, that had forbid the exportation of the *papyrus* from his dominions, does not feem to be the inventor of the *chartæ membranaceæ*; fince *Herodotus*, who liv'd long before his time, informs us, that the *Ionians* and other nations were wont to write upon goat and fheep fkins. *Jofephus* likewife tells us, that the *Jews* fent their laws written upon fkins in letters of gold to *Ptolomy*; by which it ſeems as if the writing upon ſkins was no new thing at that time among the *Jews*.

The uſe of the *pugillares* was alſo very ancient, being mentioned by *Homer*, and among the *Latins* by *Plautus*. They were made of all ſorts of wood, ivory, and ſkins cover'd over with wax: They were likewiſe of ſeveral colours, as red, yellow, green, ſaffron, white and others. Being wax'd over, any thing was eaſily writ upon them by the point of the *ſtylus*, and as eaſily rubbed out, and altered by the flat part of it. Sometimes theſe *pugillares* were made of gold, ſilver, braſs or lead; and then there was a neceſſity of an iron *ſtylus* to write or cut the letters upon them, which explains that paſſage in the 19th chap. of *Job*, *quis mihi det ut exarentur in libro, ſtylo ferreo & plumbi laminâ, vel celte ſculpantur in ſilice*. They conſiſted ſometimes of two, three, five or more pages; and thence were call'd *duplices*, *triplices*, *quintuplices*, and *multiplices*; and by the *Greeks* Διπτυχα, Τριπτυχα, *&c.*

The *diptychs* and *triptychs*, that were covered with wax, ſerv'd only for common occurrences; the other ſorts receiv'd every thing elſe that was written upon *chartæ* or *membranæ*; and were ſometimes call'd by the *Greeks Palimpſeſtæ*, from the rubbing out of the letters upon them.

The *chartæ linteæ* and *bombycinæ*, which were made of linen or cotton, were of a much later date; and from theſe we learned to make the paper now in uſe of linen rags, an invention probably of about 600 years ſtanding.

Writing was practis'd upon all theſe *chartæ* with a reed, and afterwards with a pen, except upon the *pugillares*. Theſe reeds grew upon the banks of the *Nile*; the *Greeks* likewiſe uſed reeds imported from *Perſia* for the ſame purpoſe. *Calami argentei* are alſo mentioned for writing.

Their letters were formed with liquors of various colours; but chiefly black; thence call'd *atramentum*, and in *Greek* μελαν, or μελανιον. It was ſometimes made of the blood of the cuttle-fiſh; ſometimes of ſoot. *Apelles* compos'd a black of burnt ivory, which was call'd *elephantinum*. They alſo had ink from *India* of an approv'd compoſition, as *Pliny* ſays.

The titles of their chapters and ſections were written in red or purple: Hence the titles of the *Roman* laws were call'd *rubricæ*. Their *purpura* was an exceeding bright red or crimſon,

crimſon, much in vogue with the *Byzantine* writers, and called Κιννάβαρις, which was a liquor made of the murex boil'd, and its ſhell very finely powdered; or as *Pliny* relates, of the blood of that fiſh. Almoſt all the ancient emperors wore this colour; their names were painted in it upon their banners; and they frequently wrote with it and wore it. This colour was often the diſtinction of a *Roman* magiſtrate: and to put on the purple was the ſame thing as to aſſume the Magiſtracy. This colour was ſo much admired by the poets, that they call'd every thing which was very bright and fine, purple; as *Horace* compliments the ſwan, which is never of any colour but white,

Purpureis ales oloribus.

We find even ſnow honour'd with the ſame epithet; whence ſome have imagined that *purpureus* ſignified white.

The children of the emperors, and ſuch as had a proſpect of riſing to the throne, and their guardians, ſometimes wrote with green; gold was likewiſe employ'd for the ſame purpoſe: Such as want to ſee more on this ſubject may have recourſe to *Mabillon de re diplomatica*, and *Montfaucon* in his *Palæographia Græca*.

Experiments concerning the poiſonous Quality of the Laurel-water; *by Dr.* Mortimer. Phil. Tranſ. N° 420. p. 163.

DR. *Mortimer* took a peck of laurel-leaves, and put them into an alembic, with three gallons of water, which he diſtill'd in the common way. The fire at firſt being too hot, there came over an oilyneſs with the water (1) which made it appear milky, till about half a pint had run: This taſted and ſmelt very ſtrong like apricock kernels, as did the next running, (2) which was clearer. He kept the firſt quart by itſelf, then he drew off another quart (3) which was not near ſo ſtrong in taſte or ſmell, but rather reſembled black cherry water: The remainder was almoſt inſipid. The leaves after the diſtillation look'd browniſh, were brittle, and taſted bitter without the roughneſs or apricock-kernel flavour, which they have while freſh.

In the afternoon of the ſame day the Dr. took a mongrel puppy, weighing two pounds and a half, about 16 days old; it had ſuck'd its dam in the forenoon, but had now faſted for ſix hours. He took one ounce of the third water, and gave ſome of of it to the puppy, gradually by tea-ſpoonfuls, that it might the better ſwallow it. When it had taken half the quantity, he let it go; it walked about pretty ſtrongly for five minutes, when it began to foam at the mouth, and ſoon after vomited up ſome curdled milk, and then diſcharg'd the *fœces*; after which the ſickneſs ſeemed to go off. He then gave it three tea-ſpoonfuls more; in ten minutes it began to ſtagger, and draw its hinder parts after it; it ſat upon its breech, whined, and made ſeveral efforts to vomit; but never brought any thing up: and then again would walk about, and ſit down and whine; and again ſeem to recover for about 15 minutes longer: Then thinking that the ſecond water would diſpatch it ſooner, it ſeeming to be very uneaſy, the Dr. took one ounce and a half of the ſecond running: He gave it firſt three tea-ſpoonfuls, and ſet it down, when in two minutes time it became ſtrongly convulſed, put out the tongue, and made ſtrong efforts to vomit, but to no effect; it could not ſtand, but lay with its hinder legs ſtretch'd out: Five minutes after, he gave it three tea-ſpoonfuls more, when it became more ſtrongly convulſed, rolled over and over ſeveral times, drew its head back to its rump, then lay on its ſide and panted much: About eight minutes after, he gave it two tea-ſpoonfuls more, and it had freſh and ſtrong convulſions, but kept lying on its ſide, and thus ſtretching out its four legs one after another, drawing in its flanks very quick, in 15 minutes more it died, being in all about an hour from the firſt doſe.

An hour after it was dead the Dr. opened it, and found all the contents of the *abdomen* in their natural ſtate; the ſtomach was diſtended with wind; it appeared empty of milk, bnt full of froth, and a clear *mucus* of a much thicker conſiſtence than the *liquor gaſtricus* naturally is; they had no ſmell at all; the inſide of the ſtomach was not at all inflamed.

Upon opening the *thorax* he found the lungs a little redder than ordinary, with ſome veſſels on the outward membrane very turgid: Upon cutting them out a pretty deal of clear red blood iſſued from them. The veins and both ventricles of the heart were turgid and full of coagulated blood, of a dark brown colour, which tinged his fingers of a dirty yellow, as if ſome gall had been mixt with it. There was no blood in the arteries: The *foramen ovale* was open.

Upon opening the head, the *dura mater* appear'd livid, as if bruiſed, its veſſels and the *ſinus falci-formis* were turgid and full

full of the ſame blood, as the heart and veſſels near it. The cortical ſubſtance of the brain looked of an unuſual livid colour.

Next day about 5 o'clock in the afternoon he took a large maſtiff dog weighing 75 pounds. We tied him to a poſt as he ſtood on his legs, one holding him ſtrongly by the tail, he being very fierce and unmanageable: We injected *per annum* 3 ounces of the ſecond running; in 5 minutes he trembled and ſtaggered much, would let us handle him; he drew his hinder legs after him, tumbled on his head, panted and ſlabbered, but gradually recovered ſo as to ſtand up, tho' reeling and often ſinking with his hinder legs. Fifteen minutes after, we injected an ounce more, he immediately ſtaggered and ſunk behind, and ſoon after he made water plentifully. We then led him to another kennel, where he ſoon diſcharged the *fæces alvinæ* plentifully, but of a hard conſiſtence: They ſeemed moiſtened with the laſt injected ounce, which the Dr. imagined came away by this ſtool; he therefore immediately injected another ounce, upon which the dog ſeemed more uneaſy than before, tumbling on one ſide; and in about 10 minutes after, he fell faſt aſleep, breathing with difficulty; half an hour after, the Dr. rouzed him, found him ſlabbering, drowſy, ſinking behind and giddy: About an hour and a quarter after the firſt injection, the Dr. found him as before; but provoking him with a ſtick, he bit at it, and tho' naturally fierce, he was very quiet when he did not ſtrike him; in a few minutes he reeled and fell a ſnoaring again: About 9 o'clock at night he ſeemed very well, only drowſy. We left him all that night without water and victuals, but thro' hunger he eat ſome of the ſtraw he lay on, as we found afterwards upon opening his ſtomach. Next morning we gave him water and bones; he drank greedily, and eat the bones, bread, and whatever was given him, ſeeming perfectly recovered and well all day and next night; only very thirſty, and a little drowſy, but perfectly gentle.

About 9 o'clock next morning, we faſtened him to a poſt, and put a rope into his mouth, by which his noſe was tied faſt to a rail; great care being taken that there ſhould be no rope ſo tight about his neck, as to hinder his ſwallowing, or his breathing: The Dr. then gave him 3 ounces of the ſecond running, at 3 ſeveral times with a horn ſuch as they drench horſes with; he ſwallow'd it with great difficulty, and guggled up ſome again: To prevent which, the Dr. thruſt the horn a good way down his throat. We then untied him from the poſt, to

ſee

ſee how he could walk, but he inſtantly reeled, fell down, rolled over and over, diſcharged much urine, and ſome hard *fæces*, had no motion to vomit, but dribbled much, panted and ſhew'd great difficulty of breathing, ſnuffing up the air with his noſtrils, holding his noſe up, as he ſat on his breech; for, he could not then ſtand on his hinder legs: He often ſhook his head, as if ſtung by ſome fly: He gradually recovered, and in about 20 minutes time could walk about very ſteadily on all his legs, tho' he ſtill appeared weakeſt behind: Wherefore imagining he might linger a long while, or perhaps recover entirely, we made him faſt again, and gave him 3 ounces more, near half of which he ſpilt; and out of the 6 ounces, the Dr. does not believe above 3 or 4 enter'd the dog's ſtomach: He gave one terrible loud howl, and ſunk down at once, before we could untie him from the poſt, to ſee whether he could walk or not. He never offer'd to riſe again, but lay on one ſide, panted, hung his tongue out, and ſlabber'd much, ſtretch'd all 4 legs out 3 or 4 times, and was quite dead and motionleſs in about 5 minutes time. The Dr. did not obſerve any convulſion in the muſcles of the neck and back; nor was his head and tail drawn nearer together, as in the puppy.

About ½ an hour after, the Dr. opened him, being ſtill warm. He found the bladder contracted and empty; the *rectum* ſlightly inflamed, the ſmall guts not diſtended with wind, but contracted and almoſt cloſe. The bile was evacuated in a large quantity into the *duodenum*, and was very thick, reſembling congeal'd honey; the gall-bladder was almoſt empty; but what remain'd in it was as thick as the other; to the inſide of the gall-bladder there adher'd ſeveral excreſcencies of the form and ſize of lentils, like drops of ſoftiſh yellow wax. The liver was exceedingly inflamed, and almoſt livid: The ſtomach was contracted near the *pylorus*, and again about 3 inches above it: We found ſome pieces of bone in it, a pretty deal of ſtraw, and about 2 ounces of a fluid, which ſmelt ſtrong of the laurel-water, but no *mucus*, as in the puppy: Some of the *villi* ſeemed ſlightly inflamed, the blood-veſſels being very turgid: There was a great deal of *mucus* in the *oeſophagus*, which did not ſeem inflamed. The lungs appear'd exceedingly contracted, and very red and inflamed. The *cava* and all the veins were vaſtly diſtended, and the blood in them coagulated, tho' the body was ſtill warm. There was little or no blood in the *aorta*, only upon preſſing it, a ſmall quantity of a tranſparent fluid, which the Dr. took for *ſerum*, flow'd out of it. The blood was

ſtrongly

ſtrongly coagulated in the right auricle and ventricle of the heart, being of a very dark colour, and fill'd them quite; but the left auricle and ventricle contain'd only a ſmall clot of congeal'd blood, which look'd more red and florid: The Dr. kept ſome clots of the blood out of the vein, and likewiſe out of the left ventricle, for 24 hours, but neither of them liquified or run into *ſerum*. The Dr. caus'd cut off the head, which he did not open till 24 hours after; a great deal of blood drain'd from it; and upon opening it, the veſſels did not then appear diſtended, but the *dura mater* look'd livid: There was no blood at all in the *ſinus falciformis*; the brain looked very well; the veſſels of the *plexus choroides* in each ventricle were not diſtended, but livid, nor were they burſt; there being no extravaſation in the ventricles, only a very ſmall quantity of *lympha*; which likewiſe was the caſe of the *pericardium*, which had not above a tea-ſpoonful of water in it.

In both theſe inſtances this poiſon ſeems to act by coagulating the blood; ſo that it cannot paſs the lungs or brain: And the Dr. takes it that the puppy liv'd longer than the great dog; becauſe in the puppy the *foramen ovale* was open, by which the thickened blood could paſs, and perform a few circulations more than it could have done, had it had the lungs to paſs thro'; and that in the puppy the brain was the part moſt affected, as was evident from the convulſions it had: Whereas the dog was but little convulſed, but ſeemed to die of a difficulty of breathing; and the greateſt accumulation was found at the right ventricle of the heart.

The Dr. procur'd a middling ſized ſpaniel and pour'd ſome laurel-water down his throat: He ſtruggled pretty much at firſt, and whined; but when about an ounce and a half of it was down, he ceaſed ſtruggling; that he might not be too long a dying, as much more was given him; he ſpilt about one third of the whole quantity. He was then laid down on the ground, but never offered to get up, only ſtretching out his legs, he expired directly. Upon Mr. *Ranby*'s opening him immediately, there was about 2 ounces of the laurel-water, and ſome frothy *mucus* found in his ſtomach; the veins in general were very turgid, but the blood was ſtill fluid; and indeed we could diſcern no alteration in any of the *viſcera*.

Dr. *Mortimer* gave 4 ounces of laurel-water to Dr. *Porter*, who forced 3 ounces down the throat of a pretty large dog. The creature inſtantly returned about 2 ounces by vomit, clear and unalter'd; in a few minutes he grew prodigiouſly convulſ'd, ſoon after became motionleſs, and to all appearance was dying. Within 10 minutes he vomited a ſecond time, and threw up a ſmall quantity of a viſcid, green, and very frothy matter; from which moment he began to recover, and within half an hour was perfectly well. He was kept in the yard all night, and the next morning not the leaſt diſorder being to be perceived in him, he was turned out of doors.

About half an hour after 6 in the evening Dr. *Mortimer* gave about half an ounce of the laurel-water to a middle ſized ſpaniel, weighing near 16 pounds, which he ſwallowed with great reluctance. He continued about a minute and a half upon his legs; he then began to reel, and in about 3 minutes more fell into moſt violent convulſions, and his neck and tail were ſtrongly drawn toward each other; he neither vomited nor purged, but we expected he would expire every minute, the convulſions being ſo exceedingly ſtrong, when ſome of the company called for ſome milk, in order to try whether it would prove an antidote to ſo deſperate a poiſon. We poured a little milk into his throat, which at firſt he could not ſwallow, but guggled it up again, as if almoſt ſtrangled with it. After ſeveral trials he began to ſwallow ſome, about a ſpoonful at a time, and ſeemed a little reliev'd, his convulſions leaving him, only he fetch'd his breath very hard; but he lay ſtill and ſnorted, as if in a profound ſleep; and the milk frothed out at his noſe: Upon rouzing him, he opened his eyes, and ſwallowed the milk better, which ſeemed to revive him much; ſo that the company imagining he would entirely recover, went away. The Dr. ſtaid ſome time longer, till at laſt the dog began to lap the milk himſelf, when held up to it: He vomited up a pretty deal of milk, which relieved him more; and then he lapped again, but could not ſtand on his legs. The Dr. left him in this condition about 7 o'clock, thinking he would have recovered, and left orders that he ſhould have a pan of milk, and another of water, about a pint of each, ſet by him, and that he ſhould be kept ſhut up all night: About 11 o'clock he was ſeen walking about; but next morning he was found dead, after having drank up all the milk and water, and having vomited and purged pretty much.

A solar Eclipse *observed at* Pekin July 15, 1730. N. S. *by* F. F. Koegler *and* Pereyra. Phil. Transf. N° 420. p. 179. *Translated from the* Latin.

AT the very beginning of the eclipse the rains (contrary to expectation) began to cease and at the same time the clouds to grow rarer; and a quarter of an hour after, about half a digit of the sun appear'd to the naked eye to be eclipsed.

We had got ready a machine for receiving the image of the sun thro' a telescope of 6 *Chinese* feet in length, on a table below at right angles; from whose centre a circle, divided into 10 digits after the *Chinese* manner, was accurately drawn to the magnitude of the apparent image: There were likewise ready several circles on clean paper divided in like manner (Fig. 8. Plate VII.) and to be applied successively thereon; on which were marked the phases of the eclipse for each digit, according to the inclinations of the moon to the vertical line of the sun.

In the mean time another telescope was directed to the sun, fitted with 2 object-glasses, at such distance from each other, that the threads placed in the *focus* of the telescope, and in like manner divided into 10 digits, exactly answered to the apparent magnitude of the sun, and thro' this last the moon's appulse was first observed.

H.	′			′	
a.	m.		dig.		
11	40	at 3 dig. that is,	3	36	European dig.
11	51	4 dig.	4	48	

Afterwards the sun shining very bright, the digits were marked on the image, as follows.

p.	m.					
0	2	at the centre or	5 dig. that is	6	0	European dig.
0	14		6	7	12	
0	26 ½		7	8	24	
0	40		8	9	36	
0	51	the greatest eclipse	8 ¼	9	54	
1	2	emersion	8	9	36	
1	16	20″	7	8	24	
1	27	50	6	7	12	

 Then

Then the sun, being again overcast with a thin cloud, his image was darken'd; yet with the above-mention'd telescope he was plainly seen.

H.	ʹ				
p.	m.				
1	39	emersion at	5 dig.	or 6	0
1	50		4	4	48
2	0		3	3	36

The sun emerging again out of the cloud exhibited a very bright image; on which were marked as follows.

H.	ʹ	ʺ	
2	9	20	emersion 2 dig. or 2 24
2	18	20	1 1 12
2	27	10	The end of the eclipse; which was likewise observed at the same moment of time with another very good telescope, 14 *Chinese* feet in length: In fine the sun himself corrected the clock both by shewing on a large sun-dial and an equatorial ring-dial of the observatory each minute of time, and also verifying the time by some altitudes taken.

True time
p. m. The immersions and emersions of some solar *maculæ*

H.	ʹ	ʺ	
0	22	0	The larger *macula* that was in the very periphery immerged 2 dig. to the north-east.
0	27	50	the 1st } lesser *maculæ* immerged between 2 dig. and 1.
0	31	40	2d
0	37	10	3d
0	38	35	4th
1	18	45	the two *maculæ* emerged between 3 and 4 dig. towards the south-west.
1	23	50	
2	5	20	the 4 *maculæ* emerged to the north-east.
2	7	30	
2	11	25	
2	12	25	

Eclips

Eclipses *of* Jupiter's Satellites *observed at* Pekin *in* 1729, 1730, N. S. *by* F. F. Koegler *and* Pereyra. Phil. Transf. N° 420. p. 182.

Satellite I.

		D.	H.	′	″
Immer.	*Dec.* 1729	1	4	56	0 before noon
		8	6	45	47 before noon
		10	1	14	30 before noon : Dubious
		17	3	4	5 before noon
		18	9	32	10 after noon
		25	11	22	15 after noon
		31	6	44	6 before noon
	Jan. 1730	2	1	12	26 before noon
		9	3	3	45 before noon
		10	9	31	0 after noon
		17	11	22	30 after noon
		25	3	33	30 before noon
Emer.	*Feb.*	2	11	54	15 after noon
		10	1	48	0 before noon
		17	3	44	20 before noon
		18	10	11	40 after noon
		26	0	7	45 before noon
		27	6	36	40 after noon
	Mar.	6	8	32	30 after noon
		13	10	29	0 after noon
		21	0	25	50 before noon
		29	8	53	26 after noon
	April 1730	5	10	49	55 after noon
	May	14	9	28	45 after noon
	June	22	7	55	30 after noon : Dubious
Immer.	*Nov.*	4	6	0	0 before noon.

Satellite II.

Immer.	*Dec.* 1729	27	1	41	30 before noon
	Jan. 1730	3	4	10	45 before noon
		12	7	57	15 after noon
Emer.	*Feb.*	7	7	47	27 after noon
		22	0	58	50 before noon
	Mar.	1	3	36	20 before noon : Dubious
		11	7	33	15 after noon

Satel-

Satellite II.

		D.	H.	′	″	
Emer.	*Mar.*	18	10	13	36	after noon
		26	0	51	45	before noon
	Apr.	12	7	30	48	after noon
	May	21	10	6	50	after noon

Satellite III.

Immer.	*Dec.* 1729	6	1	14	0	before noon : Dubious
		13	5	8	0	before noon
	Jan. 1730	10	8	46	30	after noon
		18	0	42	0	before noon
Emer.	*Feb.*	15	8	6	50	after noon
		23	0	5	6	before noon
	Mar. 1730	30	8	14	46	after noon
	Apr.	6	8	41	0	after noon
	May	12	8	22	0	after noon

Satellite IV.

Immer.	*Dec.* 1729	1	1	12	40	before noon
Emer.			5	48	0	before noon
Emer.	*Feb.* 1730	6	5	38	0	before noon : Dubious
Immer.		22	6	45	15	after noon
Emer.			11	30	0	after noon.

An extraordinary ſharp impoſthumation of the Liver; *by* *Dr.* Short. Phil. Tranſ. N° 420. p. 184.

DR. *Short* had a patient, that died of an impoſthumation of the liver: He opened him, and out of the loweſt and thinneſt lobes he took ſix quarts of purulent, thick, intolerably fetid, reddiſh brown, and very acid matter: For, no ſooner was it expoſed a little to the open air than it fermented exceedingly. The patient had the laſt week of his life drained off the thinner part by violent vomiting and purging to 30 or 40 times a day: It was thrown into the *duodenum* by the *ductus choledochus communis*, and there pumped up and thrown out, both by its ſharpneſs and *ſtimulus*. All the upper part of the liver to about an inch below the gall-bladder was found. The tumour had compreſſed the right kidney in ſuch a manner, that it was emaciated to leſs than the ſize of the *glandula renalis*.

A

A Proposal of a Method for finding the Longitude *at Sea within a Degree, or 20 Leagues; by Dr.* Halley. Phil. Transf. N° 421. p. 185.

UPwards of 20 years ago Dr. *Halley* added an appendix to the 2d edition of Mr. *Street's Caroline* tables, containing a ſet of obſervations he had made in 1683 and 1684, for aſcertaining the moon's motion; giving a ſpecimen of what he thought at that time might be the only practicable method of attaining the longitude at ſea. What he publiſhed then, is as follows.

'The advantages of the art of finding the longitude at ſea, 'are too evident to need any arguments to prove them: And 'having by my own experience found the impractibility of all 'other methods propoſed for that purpoſe, but that derived 'from a perfect knowledge of the moon's motion; I was am'bitious, if poſſible, to overcome the difficulties that attend the 'diſcovery thereof.

'And firſt, I found it only needed a little practice to be able 'to manage a 5 or 6 foot teleſcope, capable of ſhewing the ap'pulſes or occultations of the fixed ſtars by the moon, on ſhip'board in moderate weather; eſpecially, in the firſt and laſt 'quarters of the moon's age, when her weaker light does not ſo 'much efface that of the ſtars. Whereas the eclipſes of *Ju'piter's* ſatellites, how proper ſoever for geographical purpoſes, 'were abſolutely unfit at ſea, as requiring teleſcopes of a greater 'length than can well be directed in the rolling motion of a 'ſhip in the ocean.

'Now the motion of the moon being ſo ſwift, as to afford us 'ſcarce ever leſs than 2 minutes for each degree of longitude, 'and ſometimes 2 and $\frac{1}{2}$; it is evident, that could we perfectly 'predict the true time of the appulſe or occultation of a fixed 'ſtar, in any known meridian, we might, by comparing there'with the time obſerved on board a ſhip at ſea, conclude ſafely 'how much the ſhip is to the eaſtward or weſtward of the me'ridian of our *calculus.*

'But after much examination, and carefully collating the *Ca'roline* tables of Mr. *T. Street* (tho' generally better than thoſe 'that went before him) as likewiſe thoſe of *Tycho*, *Kepler*, '*Bullialdus*, and our *Horrox*, with many accurate obſervations 'of the moon, carefully made on land; it does not appear that 'any of theſe tables do repreſent the motions with the certainty 'required; and tho' many times the agreement ſeem ſurprizing, when

'when the errors of the ſeveral equations compenſate one ano-
'ther; yet in thoſe parts of the orb where they all fall the ſame
'way, the fault is intolerable, and the reſult many times not to
'be depended on, to more than 100 leagues; that is to ſay, it
'is entirely inſufficient.

'Yet ſtill this is the fault of the artiſt, not of the art: For,
'obſerving the periods of the lunar inequalities, which is per-
'formed in 18 years and 11 days, or 223 lunations; it is found
'that the returns of the eclipſes, and other phenomena of the
'moon's motion, are very regularly performed: So that what-
'ever error you found in a former period, the ſame is again re-
'peated in a ſecond, under the like circumſtances of the ſame
'diſtance of the moon from the ſun and *apogæum*.

'Thus from the obſervation made of the eclipſe of the ſun,
'which was ſeen *June* 22,1666, in the morning, at *London* and
'*Dantzick*, I was enabled to predict, with great certainty,
'that other, which I obſerved *July* 2, 1684, by allowing the ſame
'error I found in the *calculus* of the former: And the like will
'do with equal certainty, in the caſes *extra Syzygias*, when the
'mean and ſynodical anomalies are nearly the ſame, about the
'ſame time of the year.

'Being thus aſſured, from the certainty of theſe revolutions,
'that all the intermediate errors of our tables were not uncer-
'tain wanderings, but regular faults of the theories; I next
'thought how I might beſt be informed of the quantity and
'places of theſe defects; that being apprized how much, and
'which way my numbers erred, I might apply the difference;
'ſo as at all times to repreſent the true motion of the moon:
'Nor was there any other way, but from the heavens themſelves
'to derive this correction, by a ſedulous and continued ſeries of
'obſervations, to be collated with the *calculus*, and the errors
'noted in an *abacus*: From whence, at all times, under the
'like ſituation of the ſun and moon, I might take out the cor-
'rection to be allowed.

'And having by me the ſextant I made to obſerve the ſouthern
'ſtars at St. *Helena*, in 1677, I fixed it for this purpoſe; re-
'ſolving to have continued to obſerve, till I had filled my
'*abacus*, ſo as that it might have the effect of exact lunar ta-
'bles, capable of ſerving at ſea, for finding the longitude with
'the deſired certainty.

'With this deſign, I applied the leiſure I had in 1683, to
'obſerve diligently, as often as the heavens would permit, the
'true place of the moon, eſpecially as to longitude; and in the
ſpace

'ſpace of about 16 months I had gotten near 200 ſeveral days 'obſervations, moſt of which I collated with the *Horroxian* 'theory (whoſe *calculus* is ſomething more compendious than 'that of Mr. *Street*) and having placed the errors in an *abacus*, 'I perceived how regular the irregularities were; and that 'where the moon had been exactly obſerved formerly, at the 'diſtance of one or more periods of 223 months, I could even 'predict the errors of the tables, with a certainty not much in-'ferior to that of the obſervations themſelves. But this deſign 'of mine was ſoon interrupted by domeſtic occaſions; and ſince 'then, my frequent avocations have not permitted me to re-'ſume theſe thoughts.

'In the mean time I have taken care to preſent my obſerva-'tions, ſuch as they are, to the public, in order to preſerve 'them; aſſuring that as on the one hand they were made with 'a very ſufficient inſtrument, with all the care and diligence re-'quiſite: So in the remote voyages I have ſince taken to aſcer-'tain the magnetic variations, they have been of ſignal uſe to 'me, in determining the longitude of my ſhip, as often as I 'could get ſight of a near tranſit of the moon by a known 'fixed ſtar: And thereby I have frequently corrected my *Jour-'nal* from thoſe errors, which are unavoidable in long ſea-'reckonings.

'If therefore you happen at ſea to obſerve nicely the time of 'an occultation, or cloſe application of a ſtar to the moon; and 'can find a corrreſpondent obſervation, about the ſame mean 'anomaly and diſtance of the moon from the ſun (either among 'theſe of mine, or in any other collection of obſervations, accu-'rately made) eſpecially near the ſame time of the year; and 'above all, after the aforeſaid period of 18 years and 11 days, 'you may, without ſenſible error, from thence pronounce in 'what meridian your ſhip is; taking care in ſo operoſe a calcu-'lation to commit no miſtake; and notwithſtanding the direc-'tion the moon gives you, not confiding ſo much therein, as to 'omit any of the uſual precautions to preſerve a ſhip when ſhe 'approaches the land.

'I had intended to inſiſt more largely upon this method of 'obtaining the moon's place, and conſequently, the longitude 'at ſea; but that I find that it requires a juſt treatiſe too long 'to be here ſubjoined; and more eſpecially, that the great Sir '*Iſaac Newton* (to whom no mathematical difficulty is inſupe-'rable) has given us a true and phyſical theory of the moon's 'motions; whereby the defects of all former tables are ſo far 'amended, that it is hoped the error may ſcarce ever exceed

'3 minutes of motion, or so little in longitude, that perhaps, 'it may be thought a sufficient exactness for all the uses of na-'vigation. If therefore what is here offered find a kind ac-'ceptance from those that it chiefly concerns, I shall be encou-'raged to proceed on a work I have long meditated, to improve 'the abovementioned period, as to the abbreviating the compu-'tation of eclipses; and in general, to facilitate the too labo-'rious calculation of the moon's place *extra Syzygias.*'

Not long after, her late Majesty Queen *Anne* was pleas'd to bestow on the public an edition of the much greater and most valuable part of Mr. *Flamstead*'s observations; by help of which the great Sir *Isaac Newton* had formed his curious theory of the moon, a first sketch of which was inserted by Dr. *David Gregory* in his *Astronomiæ Physicæ & Geometricæ elementa*, published at *Oxford* in 1702; and again in the second edition of Sir *Isaac Newton*'s *Principia*, which came out in 1713, we have the same revised and amended by himself, to that degree of exactness, that the faults of the *computus*, formed therefrom, rarely exceed a quarter part of what is found in the best lunar tables extant before that time.

Being thus provided with proper materials, *viz.* a large set of observations, and a theory of the motions so very near the truth, Dr. *Halley* resumed his former design of filling up his *abacus* or synopsis of the defects of this lunar theory, and made tables to expedite the *calculus* according thereto, and compared the numbers thereof with several of the most certain of Mr. *Flamstead*'s places observed. By this it was evident that Sir *Isaac* had spared no part of that sagacity and industry so peculiar to himself, in settling the *epocha*'s and other elements of the lunar astronomy, the result many times, for whole months together, rarely differing 2 minutes of motion from the observations themselves; nor is it unlikely but good part of that difference may have been the fault of the observer: And where the errors were found greater, it was in those parts of the lunar orb, where Mr. *Flamstead* had very rarely given himself the trouble of observing; *viz.* in the third and fourth quarters of the moon's age, where sometimes these differences would amount to at least 5 minutes.

Mr. *Flamstead* was long enough possessed of the *Royal Observatory* to have had a continued series of observations for more than 2 periods of 18 years; by which he had it in his power to have done all that could have been expected from observation, towards discovering the law of the lunar motion. But he con-

contented himſelf with ſparſe obſervations, leaving wide gaps between; ſo as to omit frequently whole months together; and in one caſe, the whole year 1716. So that notwithſtanding what he has left us muſt be acknowledged more than equal to all that was done before him, both as to the number and accuracy of his accounts; yet for want of an uninterrupted ſucceſſion of them, they are not capable of diſcovering, in the ſeveral ſituations of the lunar orbit, what corrections are neceſſary to be allowed, to ſupply the deficiency of our *computus*.

On Mr. *Flamſtead*'s deceaſe, about the beginning of the year 1720, his late Majeſty King *George* I. was graciouſly pleaſed to beſtow upon Dr. *Halley* the poſt of his aſtronomical obſerver, expreſsly commanding him to apply himſelf with the utmoſt care and diligence to the rectifying the tables of the motions of the heavens, and the places of the fixed ſtars, in order to find out the ſo much deſired longitude at ſea, for the perfecting the art of navigation. Theſe are the words of his commiſſion: And here the Dr. might have thought himſelf in a condition to put in execution his long projected deſign of compleating his *abacus*, or table of the defects of the lunar numbers: But upon taking poſſeſſion, he found the obſervatory wholly unprovided of inſtruments; and indeed, of every thing elſe that was moveable; which poſtponed his endeavours, till ſuch time as he could furniſh himſelf with an *apparatus* capable of the exactneſs requiſite: And this was the more grievous to him, on account of his advanced age, being then in his ſixty fourth year, which put him paſt all hopes of ever living to ſee a compleat period of 18 years obſervation.

But hitherto, he owns, he has had ſufficient health and vigour to execute his office in all its parts with his own hands and eyes, without any aſſiſtance or interruption, during one whole period of the moon's *apogæum*; which period is performed in ſomewhat leſs than 9 years. In this time he has been able to obſerve the right aſcenſion of the moon at her tranſit over the meridian, near 1500 times (and with an exactneſs, he is bold to ſay, preferable to any thing done before) a number not leſs than thoſe of *Tycho Brahe*, *Hevelius* and *Flamſtead*, taken in one ſum, there being near 4 of his lunar obſervations for each degree of the zodiac, as alſo for each degree of the *argumentum annuum*, or diſtance of the ſun from the moon's *apogæum*: And that theſe might be duly applied to rectify the defects of our computations, he has himſelf compared with the aforementioned tables, made according to Sir *Isaac Newton*'s principles, not only his own observations, but also upwards of 800 of Mr. *Flamstead*'s.

This comparison of his own observations (and from the time he esteems them compleat) with the *computus* by the said tables, being now continued for above 9 years, he designs speedily to communicate to the public, together with the tables themselves, which have been printed, and should have been publish'd long since, had not his post at *Greenwich* given him an opportunity to examine, with proper nicety, in what parts of the lunar orb, and how much, the numbers erred. So useful an addition as this, it is hoped, may fully answer the long delay'd expectation some persons may have had of seeing the tables sooner: By means thereof, those that are qualified may, if they please, examine by their own observation the truth of what is here asserted.

Comparing likewise several of Mr. *Flamstead*'s most accurate observations made 18 or 36 years before (that is one or two periods before Dr. *Halley*'s) with those of his own which tallied with them, he had the satisfaction to find that what he had proposed in 1710 was fully verified; and that the errors of the *calculus* in 1690 and 1708, for instance, differed insensibly from what he found in the like situation of the sun and *apogæum* in 1726. The great agreement of the theory with the heavens compensating the differences, that might otherwise arise from the incommensurability and excentricity of the motions of the sun, moon and *apogæum*.

Encouraged by this event, the Dr. next examined what differences might arise from the period of nine years wanting nine days; in which time there are performed very nearly 111 lunations, or returns of the moon to the sun; but the return of the sun to the *apogæum* in that time differing above four times as much from an exact revolution, as in the period of 18 years, he could not expect the like agreement in that. However, having now entered upon the tenth year, he compared what he had observ'd in 1721, 1722, with his late observations of 1730, 1731; and he rarely found a difference of more than one single minute of motion (part of which may probably arise from the small uncertainty that always attends astronomical observations) but most commonly this difference was wholly insensible; so that by the help of what he observed in 1722, he presumes, he is able to compute the true place of the

the moon with certainty, within the compaſs of the two minutes of her motion during this preſent year 1731; and ſo for the future. This is the exactneſs requiſite to determine the longitude at ſea to 20 leagues under the equator, and to leſs than 15 leagues in the *Britiſh* channel.

It remains therefore to conſider after what manner obſervations of the moon may be made at ſea with the ſame degree of exactneſs: But ſince the worthy Vice-Preſident Mr. *Hadley* (to whom we are highly obliged for his having perfected and brought into common uſe the reflecting teleſcope) has been pleaſed to communicate his moſt ingenious invention of an inſtrument for taking the angles with great certainty by reflection (vide *Phil. Tranſ.* N° 420.) it is more than probable that the ſame may be applied to taking angles at ſea with the deſired accuracy.

An Account of the Contrayerva; *by Dr.* William Houſton. Phil. Tranſ. N° 421. p. 195.

CONTRAYERVA is a *Spaniſh* word, ſignifying as much as *herba contra (venena)* or an herb againſt poiſons. And as there are in all countries different plants to which that virtue is aſcrib'd, the name of *contrayerva* ſeems to have been given by the *Spaniards* to as many of them as have come under their knowledge: For, *Hernandez* has deſcrib'd a ſpecies of *granadilla* by that name, and there are ſeveral other roots that are commonly known by it. But Dr. *Houſton*, far from pretending to give a hiſtory of all thoſe roots, only offers a ſhort account of that plant, whoſe root is call'd *contrayerva* here in *England*, and which is ſo well known to all that any way deal in medicines.

The root itſelf being ſo commonly known, it would be ſuperfluous to deſcribe it, he, therefore, confines himſelf to the deſcription of the plant that produces it, which he had not hitherto met with to his ſatisfaction in any author.

F. *Plumier* in his book entituled *Nova plantarum Americanarum genera*, deſcribes a *genus* he calls *dorſtenia*, of which the Dr. found two ſpecies in the *Weſt Indies*; the roots of which are gather'd and exported indifferently, as being very much alike, both in appearance and virtues. One of theſe he thinks may be call'd

Dorſtenia Dentariæ radice, ſphondylii folio, placenta ovali.

The other

Dorſtenia

Dorſtenia Dentariæ radice, folio minus laciniato, placenta quadrangulari & undulata.

The firſt kind (Fig. 1. Plate VIII.) ſeems to be the *tuzpatli* of *Hernandez*, p. 147. Its roots, which are perennial, put forth in the month of *May* (or as ſoon as it happens to rain) each ſix or eight leaves four or five inches long, and as many broad, cut into ſeveral ſegments almoſt as deep as the middle rib, ſomewhat after the manner of the *ſphondylium:* They ſtand upon footſtalks five or ſix inches long; and from the middle of them come forth other footſtalks ſomewhat longer, ſuſtaining each a ſtronge ſort of body, flat, and ſituated vertically, or with one edge uppermoſt, which the Dr. has call'd *placenta.* In this ſpecies it is of an oval figure, with its longer axis parallel to the footſtalk. One ſide of it is ſmooth and green like the outſide of the *calix* in other plants; but from the other ariſe a great many ſmall yellow apices; and after they are gone, ſeveral ſmall roundiſh ſeeds begin to appear, which when ripe are ſomewhat like thoſe of *gromwell* or *lithoſpermon.* It grows in the kingdom of *New Spain*, near old *Vera Cruz*, on the high ground, by the ſide of the river.

The ſecond kind (Fig. 2.) has much the ſame number of leaves, as the former, but of a different figure: For, ſome of them are entire, and ſhaped like thoſe of a violet; others angular like ivy; and ſome almoſt as much divided as the leaves of the common maple. They are thin, and of a dark green colour, and ſmooth, or have only a few, ſcarce perceptible, hairs on the back. The pedicles that ſuſtain the flowers ariſe immediately from the root, as in the other ſpecies, and attain to the ſame height of ſix or eight inches. But the *placenta* which ſuſtains the flowers is in this kind quadrangular, wav'd about the edges, and broader tranſverſely than vertically. Yet the flowers and ſeeds themſelves are perfectly the ſame as in the other. This ſecond kind grows plentifully on the high rocky grounds about *Campechy*, where the Dr. gather'd it in perfection in the beginning of *Nov.* 1730.

The Dr. cannot gueſs why F. *Plumier* has call'd this a monopetalous plant: For, that which the latter calls the *petalum*, and the former the *placenta*, is of a green colour; and (which is of more conſequence) ſuſtains the ſeeds when ripe, and never envelopes the organs of generation when young: So that the Dr. thinks it can by no means be call'd a *petalum*, nor even properly a *calix*; and therefore he has given

given it the name of *placenta*, whose office it certainly performs.

The Dr. has not been able to observe exactly the structure of the organs of generation, because of their excessive smallness; but they appear to the naked eye, as represented in the figures, and in *Plum. N. G. Tab.* 8. The *Dorstenia sphondylii folio, dentariæ radice* of *Plumier* differs from both of the Dr's: For, in the former's drawings, done by order of the late King of *France*, of which the Dr. had seen a copy in the collection of the late Dr. *Sherrard*, the leaves are represented serrated, the *placenta* quadrangular, and the roots consisting of several knobs tied together lengthwise. From which last particular, the Dr. is persuaded that the root of that species is the *darkena radix*, mentioned by *Clusius* in his *Exotics* p. 83.

Concerning Diamonds *found in* Brazil; *by Dr.* De Castro Sarmento. Phil. Transf. N° 421. p. 199.

DR. *De Castro* had the following account of diamonds from a gentleman, who for these 15 years last past had liv'd and dug gold in the gold mines in *Brazil*, belonging to the King of *Portugal*; and who brought from thence several diamonds of considerable value, lately found in those places.

In the *Prince*'s town, capital of the county *Do Serro do Frio*, belonging to the Government of the gold mines, there is a place near the said town, call'd by the natives *Cay the Merin*, where they used to dig gold for many years, as also from a small river, call'd *Do Milho Verde*. The miners, that dug gold in those places, turned up the grounds and sands of the banks of the said river, in order to extract the gold therefrom, and by so doing found several diamonds, which then they did not prize as such: For, some of the miners kept several stones for their figure and curiosity, which stones (tho' so valuable) by length of time they neglected and lost; and did so till the year 1728, at which time one of the miners coming to work there, and being better acquainted, deemed them to be diamonds, and made experiments upon them; and finding them really such, began to seek for them in the same ground and sand, where the former miners had ignorantly left them; and so the rest of the people followed his example.

After

After they had thoroughly examined the places aforesaid, they began to search for them in the river itself; and they actually find diamonds there, but with more difficulty and trouble: For, in the former places they found them together among the earth and sand, as they lay; but in the river, as the sand is more dispersed, they lie farther from one another.

Experience and common reason teach the people there, that these diamonds came from another place by the current of the waters, and are not the natural product of the situation where they now are found.

They are using all possible diligence to find out the place where they grow. They have not hitherto discover'd it; but their great hopes are very much encouraged upon account of having near the said situation several mountains, where nothing is to be seen but fine solid crystal rocks.

The diamonds, that have been found, are commonly from one grain to six carrats; some larger, and amongst these, one of 45 carrats. Their colour, solidity, and the rest of their properties are the same with those of the oriental ones; only it was observ'd, that those diamonds that lay more superficially, and exposed to the air and sun, were more scurfy; and consequently lost more by polishing than the others.

Meteorological Observations, made for six Years at Padua: *by S.* Polenus. Phil. Transf. N° 421. p. 201. *Translated from the* Latin,

IN the first place it is to be observ'd, that S. *Polenus*, in denoting the times, has, after the manner of astronomers, computed the beginning of each day from noon; and that he has made his observations a little after noon; unless otherwise prevented.

He made use of the old style in designing the times, and of the *English* foot and its parts, in measuring. And, if in the progress of the observations, any of them be accommodated to the new style, and *French* measures, he mentions that alteration.

In measuring the snow, he caus'd melt it, and then he measur'd it in the same manner as rain-water.

The tube of his barometer is pretty large, and the diameter of the cistern or vessel, containing the stagnant mercury is almost 20 times the diameter of the tube: Wherefore, in

the

the aſcent and deſcent of the mercury in the tube, the height of that in the veſſel may be with ſafety conſidered, as invariable.

His thermometer is one of thoſe of M. *Amonton*'s invention, that illuſtrious ornament of the *French Academy*, with a recurve tube terminating in a phial, or ball, whoſe lower part is fill'd with quickſilver, and upper part with air; and by the greater or leſſer dilatation of the air, according to the different degrees of heat, the mercury riſes more or leſs in the tube: But becauſe the extremity of the tube is open; the true height of the thermometer muſt be compounded, of the obſerv'd height of the mercury in the tube of the thermometer, and of the height of the mercury in the barometer, collected together into one ſum; and that height be ſet down in the Ephemerides. His thermometer hangs in a room (where there is ſcarcely ever any fire made) with one ſide fronting the ſouth, and with the other, the eaſt; for he had no convenient place regarding the north. Upon immerſing the ball of his thermometer into ice; the mercury falls 47 inches 30 dec. and into boiling water, it riſes 63 inches 10 dec. He moreover always uſed the ſame inſtruments, and thoſe directed towards the ſame parts of the heavens.

Were it neceſſary, it might be made appear, from the obſervation juſt mentioned, and thoſe above, that our air in the colder winter ſeaſon very nearly approaches the cold of ſnow, as has been obſerv'd in the *Memoirs of the Royal Academy of Sciences* at *Paris* for the year 1711, p. 2.) but in ſummer, that the heat of our air falls greatly ſhort of that of boiling water. But this is a thing plain of itſelf.

S. *Polenus* ſets down the direction of the winds for every day; and denotes their ſeveral degrees of ſtrength, *viz.* when pretty ſtrong, ſtronger, or ſtrongeſt of all, by the numbers 2, 3, or 4, omitting 0, the ſign of a perfect calm, and 1, that of the gentleſt breath of wind: And there is no one, who is but indifferently ſkill'd in theſe matters, but knows, that in the loweſt region of the atmoſphere near us, where anemometers are placed, ſome one particular wind is often obſerv'd, while other and different winds reign in the upper regions.

After premiſing theſe things, the following table exhibits the quantities of rain-water, and of melted ſnow, collected together; as the ſums correſponding to each month, and taken from obſervations, bear.

	1725		1726		1727		1728		1729		1730	
	Inc.	dec	Inc.	dec	Inc.	dec	Inc.	dec	Inc.	dec	Inc.	dec
Jan.	0	521	1	355	5	955	4	278	1	085	0	112
Feb.			1	460	1	073	1	050	1	245	2	906
March	0	889	3	168	1	878	4	832	2	902	4	592
April	4	019	3	998	0	498	1	419	2	768	1	638
May	3	625	1	368	3	530	3	403	2	634	4	467
June	0	036	2	608	2	476	2	103	3	134	6	205
July	2	297	2	357	2	930	4	016	4	526	2	339
Auguſt	5	185	1	268	5	067	5	186	0	578	4	269
Sept.	2	647	2	900	4	164	6	948	3	267	1	090
Oct.	7	104	0	179	6	576	5	163	6	294	5	254
Nov.	3	636	2	277	5	091	6	836	4	186	0	534
Dec.	0	030	2	390	7	169	7	599	2	804	0	894
Sum of the whole Year.	29	989	25	328	46	407	52	833	35	423	34	300

If the ſame months of theſe ſix years be collected together into one ſum; it will be found by the table, that the leaſt quantity of water fell in the month of *February*; as not exceeding 7 inches 734 dec. and that the greateſt quantity fell in the months of *October*, which was 30 inc. 570 dec. Beſides, it eaſily appears by the ſame table, that the year 1726 was drier than the other years, there having fallen but 25 inches 328 dec. and that the year 1728 was wetter than the other years, in which were gather'd 52 inches 833 dec.

Beſides, S. *Polenus* collected apart the numbers of the quantities of water, that fell in each ſeaſon of the year; reckoning the ſeaſons for each year, in ſuch manner as to refer the beginning of winter to the 10. of *December* of the preceeding year; and thus beginning the reſt of the ſeaſons at the 10 of *March*, *June* and *September* reſpectively. The ſums found are exhibited in the following table.

Winter

	Winter.		Spring.		Summer.		Autumn.	
	Inc.	dec.	Inc.	dec.	Inc.	dec.	Inc.	dec.
1725	0	912	8	167	7	584	13	327
1726	2	815	9	006	7	355	4	999
1727	8	281	5	916	11	875	15	497
1728	11	419	10	752	12	83	20	556
1729	7	470	9	430	6	310	13	617
1730	8	693	8	817	12	818	6	562
Sum	39	490	52	88	58	25	74	508

From which table it is evident that the reſpective quantities of water, in ſummer and autumn for every year, was greater than that in winter and ſpring.

If the reſpective quantities for each ſeaſon be collected into one ſum; and theſe ſums be compared together, it will eaſily appear, that the increments proceed in the ſame order as the ſeaſons do, beginning from winter; that is, that the leaſt quantity of water is had in winter, a greater in ſpring, a ſtill greater in ſummer, and the greateſt of all in autumn.

It is very well known, that rain is indicated by the falling of the mercury in the barometer, and fair weather, by its riſing: To find out, therefore, in ſome meaſure, what theſe indications could do towards gaining ſome anticipated knowledge by the barometer of future rain, he collected the days on which it rain'd in the aforeſaid ſix years into various ſums, according to the variety of the winds, and the increaſe and decreaſe of the height of the barometer from the noon of the preceeding day to that of the day on which it rain'd. The table is as follows.

The height of the barometer decreaſing on the noon of the preceeding day to that of the day on which it rain'd.		The height of the barometer encreaſing from the noon of the preceeding day to that of the day on which it rain'd.	
Nnmber of days it rain'd,	The wind what, on the noon of the days on which it rain'd.	Number of days it rain'd.	The wind what, on the noon of the day on which it rain'd.
86	N	64	N
61	N E	41	N E
33	E	16	E
28	S E	17	S E
44	S	21	S
42	S W	15	S W
49	W	20	W
35	N W	17	N W
Sum 378		Sum 211	

 After

After finiſhing this table S. *Polenus* was ſurprized that there was no greater difference between the numbers of the increaſe and decreaſe of the height of the barometer, than that between 378 and 211.

He owns, that the height of the barometer increaſing ſeveral times from the noon of the preceeding day to that of the day on which it rained; yet it began to decreaſe after the noon of the ſame day on which it happened to rain: Beſides, that that increaſe may be taken ſeveral times, as an indication of future fair weather after a ſhort rain; and that regard is likewiſe to be had to the quantity of rain.

Yet often from theſe no plea can be drawn for the conſtancy of that law, by which ſome would make the decreaſe of the height of the barometer, the indication of rain, and its increaſe the indication of fair weather; ſo that there is ſtill ſomething wanting, whereby to prognoſticate theſe phenomena.

Upon a compariſon like the former, of the days in the ſaid ſix years, on which it ſnow'd; he found that the fall of ſnow anſwers better than rain to the decreaſe of the height of the barometer; as may be ſeen in the following table.

The height of the barometer decreaſing from the noon of the preceeding day to that on which it ſnow'd.		The height of the barometer increaſing from the noon of the preceeding day to that on which it ſnow'd.	
Number of days it ſnow'd.	The wind what, on the noon of the days on which it ſnow'd.	Number of days it ſnow'd.	The wind what, on the noon of the days on which it ſnow'd.
4	N	4	N
6	N E		
1	E		
1	S W		
1	W		
1	N W		
Sum 14		Sum 4	

Beſides, he collected the reſpective ſums of the height of the barometer and thermometer for every year; from which he afterwards extracted the mean altitudes correſponding to each day of the ſaid years, as is exhibited in the following table.

	Sum of the heights of barometer.		Sum of the heights of thermomet.		The mean height of the barom. for each day.		The mean height of the therm. for each day	
	Inches	Dec.	Inch.	Dec.	Inch.	Dec.	Inch.	Dec.
1725	10854	26	18287	66	29	74	50	10
1726	10823	8	18268	93	29	65	50	5
1727	10831	17	18325	96	29	67	50	21
1728	10864	72	18419	81	29	68	50	33
1729	10842	23	18326	62	29	70	50	21
1730	10853	75	18264	18	29	74	50	4

If moreover, the height of the barometer, not of each year, but of all the ſix years be collected into one ſum only, the mean height of the barometer, correſponding to each day of all the ſaid years, will be found to be 29 inch. 70 dec.

And if the heights of the thermometer, not of each year, but of all the ſix years, be collected into one ſum only, the mean height of the thermometer, correſponding to each day of all the ſaid years, will be found to be 50 inch. 16 decim.

Wherefore, by bare inſpection into the table, it is eaſy to underſtand, that the mean heights both of the barometer and thermometer for each day of each year differ but a very few parts from the mean heights of the days, that ariſe from theſe ſix taken collectedly.

He then reduced the greateſt and leaſt heights of the barometer, as alſo the greateſt and leaſt heights of the thermometer into the following table, that they might be compared together at one view.

Years

Years	Months	Days O.S.	Hour h	Hour ′	greatest height of barom. inc.	greatest height of barom. dec.	least height of barom. inc.	least height of barom. dec.	height of thermom. inc.	height of thermom. dec.	winds	weather
1725	*Jan.*	19		15	30	28			48	45	W.	fair
	Dec.	8	4	15			28	56	47	98	S. W. 4	the ſky almoſt overcaſt
1726	*Nov.*	28		15	30	18			48	70	N.	fair
	Feb.	13		15			28	92	48	62	S. W.	the ſky almoſt overcaſt
1727	*Nov.*	20		15	30	24			48	88	N. W.	fair
	Oct.	29	3				28	80	49	6	S. 2	the ſky overcaſt
1728	*Dec.*	2		15	30	20			48	98	N.	thin clouds
	Dec.	12		15			29		48	60	N. W.	ſmall rain
1729	*Dec.*	20		15	30	30			48	88	W.	the ſky almoſt overcaſt
	Nov.	10		15			28	90	49	30	N.	rain
1730	*Dec.*	20		15	30	40			48	20	N.	fair
	Feb.	27		15			28	98	48	78	S. E.	Sun-Shine and clouds alternately.
					height of barom. inc.	height of barom. dec.	greateſt height of thermom. inc.	greateſt height of thermom. dec.	leaſt height of thermom. inc.	leaſt height of thermom. dec.		

Years	Months	Days O. S.	Hours h	greatest height of barom. inc.	dec.	least height of barom. inc.	dec.	height of therm. inc.	dec.	winds	weather
				height of barom. inc.	dec.	greatest height of thermom.		least height of therm. inc.	dec.		
1725	Jul.	9	15	29	64	52	50			S. 2	fair
	Dec.	23	15	29	25			47	82	N. E.	sun-shine and clouds alternately.
1726	Jul.	15	15	22	74	52	40			S.	fair
	Jan.	14	15	29	68			47	68	W.	the sky almost overcast
1727	Jul.	13	15	29	60	52	18			E.	sun-shine and a few clouds
	Jan.	2	15	29	68			48	15	S. E.	the air foggy
1728	Jun.	22	15	29	68	52	54			S.	sun-shine and a few clouds
	Dec.	26	15	29	30			48	8	N. 2	the sky almost overcast
1729	Jun.	25	15	29	70	52	28			N. E.	fair
	Jan.	14	15	29	50			47	82	S. W.	fair
1730	Aug.	4	15	29	76	52	28			N.	sun-shine and clouds alternately
	Dec.	23	15	30	30			47	58	W.	fair

That

That the quantities of water, which fell, might be compar'd with thofe in the Memoirs of the Royal Academy, he reduced the *Englifh* meafures into *French*, by dividing a Royal *Paris* foot, into inches and lines. And he collected the fums for each year according to the N. S. as may be feen in the following table.

Years N. S.	inch of *Paris* foot	lines
1725	28	1 $\frac{1}{2}$
1726	23	2 $\frac{1}{2}$
1727	42	11
1728	49	9 $\frac{1}{5}$
1729	34	1 $\frac{2}{5}$
1730	32	1 $\frac{5}{6}$
	Sum 210	3 $\frac{1}{2}$

Wherefore, if 210 inc. and 3 lin. and $\frac{1}{2}$ be divided by 6 years; the quotient will be 35 inc. $\frac{7}{12}$ lin. the mean quantity of water that fell, correfponding to each year. The mean quantity of water that falls at *Paris* in a year (as it is in the Memoirs of the Royal Academy for the years 1711, 1714, 1715, and elfewhere) is reckoned to be 19 inches. Wherefore the mean quantity at *Padua* exceeds the mean quantity at *Paris* by 16 inches $\frac{7}{12}$ lines. Or, if we take for the mean quantity at *Paris* 18 inches eight lines (as is gather'd from three years obfervation in the *Memoirs* for 1719) the difference will be 16 inches 4 $\frac{7}{12}$ lines. It therefore plainly appears, that a greater quantity of water falls at *Padua* than at *Paris*.

It is to be noted, that from the noon of *Auguft* 23, 1727 O. S. (the wind at north) to the noon of the following day, namely the fpace of 24 hours, there fell at *Padua* three inches and a half lin. that is 36 and $\frac{1}{2}$ lin. of rain; which indeed is greater than any that ever fell at *Paris* in the fame fpace of time; as may be gather'd from the *Memoirs of the Royal Academy*.

If the greateft height of the barometer, obferv'd at *Padua December* 20, 1730, be reduc'd to *Paris* meafure, it will be found to be 28 inches, 6 lines: But the leaft height of the barometer on *December* 8, 1725, will be found 26 inches 9 lines and $\frac{1}{4}$. Wherefore the difference between the greateft and

and leaſt height of the mercury in the barometer will be 1 inch 8 lines and $\frac{3}{4}$.

In like manner aſſuming the ſix years obſervations, which M. *de la Hire* made in the Royal Obſervatory at *Paris* (namely from 1699 to 1705) S. *Polenus* found the greateſt height of the barometer on *December* 10, 1704, to have been 28 inches, 4 lines and $\frac{1}{6}$; and the leaſt height on *December* 20, 1703, 26 inches, 5 lines; and conſequently that the difference between the greateſt and leaſt height of the mercury in the barometer was 1 inch 11 lines and $\frac{1}{6}$. The difference therefore between the greateſt and leaſt height of the mercury in the barometer (according to the aforeſaid obſervations) was found greater at *Paris*, than at *Padua* by 2 lines $\frac{5}{12}$. And it has been long ſince obſerv'd by ſome, that theſe differences are found ſo much the leſs, the nearer the places, where the obſervations are made, are to the equator.

In the next place S. *Polenus* proceeds to his obſervations on the magnetic declinations; and theſe he diſcuſſes briefly. It is now well known, that at different hours of the ſame day, ſome ſmall changes happen in the declination of the magnetic needle; ſo that the ſame conſtant declination is not to be obſerv'd for one entire day; but varies ſometimes a few minutes of a degree: It is beſides well known, that different needles (eſpecially thoſe touch'd by different magnets) do not entirely exhibit the ſame declination, but ſometimes vary ſome few (and but very few, when the needles are made by good workmen) minutes of a degree. Excepting therefore the very ſmall variations, that eaſily ariſe from theſe cauſes, S. *Polenus* for theſe whole ſix years obſerved the declination of the magnet 13 degrees towards the weſt. The compaſs he makes uſe of, and on which he greatly depends, was made by *Bernard Facinus* a knowing artiſt, and eſpecially ſkilled in theſe matters, and very diligent; the needle is ſix inches long, and weighs 32 grains. S. *Polenus* adds this one thing, namely, that he ſuſpects (for one cannot affirm any thing with certainty concerning ſo ſmall a variation) that the declination of the needle did in that time rather decreaſe than increaſe 10 minutes.

An Account of the Coccus Polonicus; *by M.* Breynius Phil. Tranſ. N° 421. p. 216.

M. *Breynius* (after having briefly accounted for the two kinds of the *cocci tinctorii* now in uſe, *viz.* that of *Pliny* gather'd from the *ilex*, and the *American coccus* or cochinil) proceeds to give us the natural hiſtory of the *coccus polonicus*, which he calls *radicum*; becauſe it is chiefly found adhering to the roots of the *polygonum cocciferum*, *Koſmaczeh Polonis* C. B. *Koſmaczek Philoſella Herbareo Polon.* This he takes to be the *polygonum Germanicum*, *incanum*, *flore majore perenni Raii*: Of which he has given a print with the *cocci*, as they ſtick to the roots.

The *coccus*, he ſays, is found ſometimes ſingle, ſometimes more, nay 40 adhering to one plant of different ſizes, from a poppy ſeed to that of a white pepper-corn. It is roundiſh, ſmooth, and of a purple violet colour, and in a thin cuticle incloſes a blood-red *ſuccus*: One half or more of it is cover'd with a rough, dark, brown cruſt, by which it adheres to the roots.

The countrymen gather it about *Midſummer*, and dry it with a ſlow fire in earthen platters.

In open glaſſes he expos'd to the ſun ſeveral of theſe *cocci*, and found that by the 24th of *July*, every one, according to its ſize, had excluded a ſmall worm with ſix feet. That part which ſeemed to be the head had two ſhort carneous *antennæ*: For, he could not perceive with glaſſes any thing either like mouth or eyes. On the back lengthways there were two *ſulci*, more or leſs viſible, according to the different motions of the *animalculum*. Its feet ſeemed armed with claws, and the firſt pair ſtronger and darker than the reſt. The whole worm was of an obſolete purple colour, and had ſeveral briſtles of a brown grey.

Theſe, after 10 or 14 days, lay in a ſtate of reſt, and ſoon became cover'd with an exceeding white fine lanuginous ſubſtance; in which condition they continued five or eight days longer; and then laid their eggs, 50, 100, or more a-piece; which to the naked eye appear'd but like ſo many red oblongiſh points; but with glaſſes looked like ants eggs, almoſt tranſparent with diluted blood-red contents.

Theſe eggs, being again expoſed in the ſun about *Bartholomew-tide*, were hatch'd a month after, when ſome *vermiculi* were excluded, which in the microſcope appear'd to be

hexapods

hexapods of a purplish hue, with two *antennæ* at their head, and two greyish bristles at their tails, scarce visible except upon black paper.

He supposes these last excluded *vermiculi*, after some wanderings, at last to fix themselves to the roots, and some of the lowest contiguous branches of the *polygonum*, where being depriv'd of local motion and sense, by some way or other, they imbibe that *succus* from the plant; and at last become the *cocci* so call'd, or vesicles full of that blood-red *succus* so useful in dying.

A large Umbilical Rupture; by Mr. Ranby. Phil. Transf. N° 421. p. 221.

ABOUT six years before, a man gave his wife a kick on the belly; and from that time she complain'd of a pain, and a swelling about the navel, which in time increas'd to about the size of a man's head, seldom giving her any uneasiness but by its weight; and that chiefly when her bandage was off, which she generally wore, except when her diet, or any other accident, brought on a *diarrhœa*, which was always attended with colic pains, particularly, in the rupture; to ease which, she had been advised to iron it with a hot iron; and she had thereby burnt it so often that there remain'd on the skin several large *cicatrix*'s. Three days before her death she was taken with the *diarrhœa*, attended with a slight fever.

Upon opening the bag, the caul first presented itself to view; the greatest part of which adhered to the *peritonæum*. Upon removing this, the small guts to the length of two ells and a half, were contained in this bag, together with all the *colon*, except so much of it as is below the left kidney; and the beginning of the *colon*, with the *cæcum*, was attached to the mesentery, in such manner, as to be but two inches distant from the *pylorus*; which, with about one third of the stomach, was by this means drawn into the bag. The beginning of the *duodenum* just enter'd the bag, and then returned out again; which, with but a small portion of the *jejunum*, was the chief that remain'd in the *abdomen*.

Experiments concerning the Electricity of Water; by Mr. Stephen Gray. Phil. Tranf. N° 422. p. 227.

IN the former account of experiments in *Phil. Tranf.* N° 417. p. 18, Mr. *Gray* defcribed the manner of communicating an attraction to a bubble of foaped water: But he has now found, that even a body of water receives an attractive virtue, and alfo a repelling one, by applying the excited tube near it, after the fame manner as folid bodies do. To perform this experiment, he caus'd a wooden difh to be turned, with a fcrew-hole at the bottom, but not fo far as to come thro' the wood: This was fcrew'd on to the upper end of one of the ftands, mentioned in the former experiments, the other top being taken off: The difh was about four inches diameter, and one inch deep. Then the ftand was fet on a cake of rofin, or a plate of glafs, or the brim of a drinking glafs, or of a cylindric one, fuch as are ufed for water-glaffes. The glafs muft be firft warmed; then the difh being filled with water, the tube is rubbed, and mov'd both under the difh and over the water three or four times, without touching them. After it has been excited, not only the difh, but likewife the water, becomes electrical; and if a fmall piece of thread, or a narrow flip of thin paper, or a piece of fheet-brafs, commonly call'd tinfel, be held over the water in an horizontal pofition, within about an inch or fometimes more, any of the faid bodies will be attracted to the furface of the water, and repelled, but not fo often as by folids: If a pendulous thread be held at fome diftance from the outfide of the difh, it will be attracted and repelled by it feveral times together with a very quick motion, but not at fo great a diftance as when the difh is empty.

An experiment fhewing that water is attracted by the tube, and that the attraction is attended with feveral remarkable and furprifing phenomena.

This experiment being to be made with fmall quantities of water; Mr. *Gray* at firft made ufe of fome of the brafs concave little difhes, in which he formerly ground microfcopes; but he has fince caus'd make a more convenient apparatus, which confifts of a fmall pedeftal of about four inches and a half long, the bafe of ivory about two inches diameter. Upon the upper end, as in the larger ftand, there is a fcrew, upon which is fcrew'd one of the little difhes, made of ivory: Of thefe he has feveral fizes, from three quarters to one tenth of an inch in diameter. When any one of thefe little veffels is filled

filled with water, ſo as that it may ſtand above the brims of the cup, and has acquired a ſpherical ſurface (as it will do in the ſmalleſt cups) let it be ſet on the table with the little ſtand to which it had before been ſcrew'd; or which is better upon the large ſtand mentioned above, the great diſh being taken off, and the ſmall plain top ſcrew'd on; being thus prepared, let the tube be excited, and held over the water at the diſtance of about an inch or more. If it be a large tube, there will firſt ariſe a little mountain of water from the top of the drop, of a conical form, from the vertex of which there preceeds a light (very viſible when the experiment is perform'd in a dark room) and a ſnapping noiſe, almoſt like that when the fingers are held near the tube, but not quite ſo loud, and of a flatter ſound. Upon this the mountain, if it may be ſo call'd, falls into the reſt of the water, and puts it into a tremulous and waving motion. Mr. *Gray* a few days before repeated this experiment in the day-time, where the ſun ſhined; he perceived that there were ſmall particles of water thrown out of the top of the mount; and that ſometimes there would ariſe a very fine ſteam of water from the vertex of the cone, in the manner of a fountain, from which there iſſued a fine ſtream, or vapour, whoſe particles were ſo ſmall as not to be perceptible. Yet it is certain that it muſt be ſo; ſince the under ſide of the tube was wet, as he found when he came to rub the tube again; and he has ſince found, that tho' there does not always ariſe that cylinder of water, yet there is always a ſteam of imperceptible particles thrown on the tube, and ſometimes to that degree as to be perceptible on it. When ſome of the larger cups are to be made uſe of, they are to be fill'd as high as may be without running over: The ſurface will be flat about the middle part; but when the tube is held over it, the middle part will be decreaſed into a concave, and the parts towards the edge be raiſed; and when the tube is held over againſt the ſide of the water, the little conical protuberance of water iſſues out with its axis horizontally, and after the crackling noiſe returns to the reſt of the water; and ſometimes there will be thrown out of it ſmall particles of the ſame, as from the ſmaller portions of water above-mentioned.

The laſt experiment was repeated with hot water; when the water was attracted much ſtronger, and at a much greater diſtance: The ſteam ariſing from the vertex was in this caſe viſible, and the tube was ſprinkled with large drops of water. He tried the

the experiment in the ſame manner upon quickſilver, which was likewiſe raiſed up; but by reaſon of its great weight, not to ſo great a height as the water; the ſnapping noiſe was louder, and laſted much longer than in the water.

The Method of making the beſt Mortar *at* Madraſs; *by Mr.* Pyke. Phil. Tranſ. N° 422. p. 231.

TAKE 15 buſhels of freſh pit-ſand, well ſifted; add thereto 15 buſhels of ſtone-lime: let it be moiſtened or ſlacked with water in the common manner, and ſo laid 2 or 3 days together: Then diſſolve 20 pound of *jaggery*, which is coarſe ſugar (or thick moloſſes) in water, and ſprinkling this liquor over the mortar, beat it up together, till all be well mixed and incorporated; and then let it lie by in a heap. Then boil a peck of *gramm* (which is a ſort of grain like a tare, or between that and a pea) to a jelly, and ſtrain it off thro' a coarſe canvaſs, and preſerve the liquor that comes from it. Take alſo a peck of *Myrobalans*, and boil them likewiſe to a jelly, preſerving the water in like manner as the other; and if you have a veſſel large enough, you may put theſe 3 waters together, that is, the *jaggery water*, the *gramm water* and the *Myrobalans*. The *Indians* uſually put a ſmall quantity of fine lime therein to keep their labourers from drinking of it. The mortar beat up, and when too dry ſprinkled with this liquor, proves extraordinary good for laying brick or ſtone therewith, keeping ſome of the liquor always at hand for the workman to wet his bricks with; and if this liquor prove too thick, dilute it with freſh water. Obſerve likewiſe, that the mortar here is not only to be well beaten and mixed together, but alſo to be laid very well; and every brick or piece of brick, fluſhed in with the mortar, and every cranny fill'd up, yet not in thick joints, like the common *Engliſh* mortar; and alſo over every courſe ſome to be throwed on very thin: And where the work hath ſtood tho' but for a breakfaſt or dining time, before you begin again wet it well with this liquor, with a ladle and then lay on your freſh mortar: For, this mortar, notwithſtanding its being thus wetted, dries much ſooner than one not uſed to it would conceive, but eſpecially in hot weather. For very ſtrong work the aforeſaid mortar is improved as follows. Take coarſe tow and twiſt it looſely into bands as thick as a man's finger (in *England* ox-hair is uſed inſtead of this tow) then cut it into pieces of about an inch long, and untwiſt it ſo as to be looſe; then ſtrew it lightly over the other mortar, which is at the ſame time to be kept turning over; and ſo this ſtuff to be beat into it,

kee-

keeping labourers continually beating it in a trough, and mixing it till it be well incorporated with all the parts of the mortar. And whereas it will be apt to dry very faſt, it muſt be frequently ſoftened with ſome of the aforeſaid liquor of *jaggery*, *gram*, and *myrobalans*, and ſome freſh water; and when it is ſo moiſtened and beat, it will mix well, and with this they build (tho' it be not uſual to build common houſe-walls thus) when the work is intended to be very ſtrong: As for inſtance, for *Madraſs* church ſteeple, that was building when Mr. *Pyke* was laſt there, and likewiſe for ſome ornaments, as columns, good arched work, or imagery ſet up in gardens, it is thus made. Tho' for common buildings about *Madraſs*, where the rainy ſeaſon holds not above 3 months in the year, and ſometimes leſs, they uſually lay all the common brick-work in a loomy clay, and plaiſter it over on both ſides with this mortar, which is ſtill farther to be improved. Thus far for building-mortar. Having your mortar thus prepared, as is before deſcribed, you muſt ſeparate ſome of it, and to every ½ buſhel, you are to take the whites of 5 or 6 eggs, and 4 ounces of *Ghee* (or common unſalted butter) and a pint of butter-milk, beaten all well together: Mix a little of your mortar with this, till all your *Ghee*, whites of eggs and buttermilk be ſoaked up; then ſoften the reſt well with plain freſh water; and ſo mix all together, and let it be ground, a trowel full at a time, on a ſtone, with a ſtone-roller, in the ſame manner as chocolate is uſually made, or ground in *England*; and let it ſtand by in a trough for uſe: And when you uſe it, in caſe it be too dry, moiſten it with ſome water, or the abovementioned liquor. This is the ſecond coat of plaiſtering.

Note, when your firſt coat of plaiſtering is laid on, let it be well rubbed on with a hardening trowel, or with a ſmooth brick, and ſtrewed with a gritty ſand, moiſtened, as occaſion requires, with water, or the abovementioned liquor; and then well hardened on again, which, when half dry, take the laſt mentioned compoſition for your fine plaiſtering; and when it is almoſt dry, lay on your whitening varniſh: But if your work ſhould be quite dry, then your *Chinam* liquor muſt be waſhed over the work with a bruſh. The beſt ſort of whitening varniſh is made as follows. Take one gallon of *toddy*, a pint of butter-milk, and ſo much fine *chinam*, or lime, as ſhall be proper to colour it, add thereto ſome of the *chinam* liquor before-mentioned, waſh it gently over therewith; and when it is quite dried in, do the ſame again: And a plaiſter thus made is more durable than ſome ſoft ſtone, and holds the weather better in *India*, than any of the bricks they make there. In ſome of the

the fine *chinam*, that is to endure the weather, and where it i likely to be ſubject to much rain, they put *oleum ſeſami*, gingerly oil, inſtead of *ghee*; and likewiſe in ſome they boil the bark of the *mango-tree*, and other barks of aſtringent natures and aloes, which grow in great plenty by the ſea-ſhore. But to all the fine *chinam*, which is for outſide plaiſtering, they put butter-milk, called *Toyre*: And for inſide work they uſe glue made very thin and weak, inſtead of ſiſe, for white-waſhing; and ſometimes they add a little gum to it.

N. B. Whereas ſundry ingredients here mention'd are not to be had in *England*, it may not be amiſs to ſubſtitute ſomething more plentiful, which Mr. *Pyke* takes to be of the ſame nature. As to all the aſtringent barks, he takes oaken bark to be as good as any: Inſtead of aloes, either turpentine, or the bark and branches of the ſloe-tree. Tho' turpentine be not ſo ſtrong; yet if uſed in greater quantity may ſerve for the ſame purpoſe. But there is a ſort of *aloes hepatica*, very cheap. Inſtead of *myrobalans*, ſome juice of aloes, or ſloes; and inſtead of *jaggery*, coarſe ſugar, or moloſſes, will do; inſtead of *toddy*, which is a ſort of palm-wine, the liquor from the birch tree comes near to it.

Note, that in *China*, and ſome other parts, they temper their mortar with blood of any ſort of cattle; but the ingredients beforementioned are ſaid to be as binding, and do full as well, and make not the mortar of ſo dark a colour as blood will do. The plaiſtering above deſcribed is thought in *India* vaſtly to exceed any ſort of *ſtucco-work*, or plaiſter of *Paris*; and Mr. *Pyke* has ſeen a room done with this ſort of terras-mortar, that has fully come up to the beſt ſort of wainſcot work, both in ſmoothneſs and beauty.

A ſingular ſort of Colic; *by Dr.* Huxham. Phil. Tranſ. N° 422. p. 236. *Tranſlated from the* Latin.

A Man of 40 years of age, of a bilious and ſcorbutic habit, for a long time greatly laboured under colic pains, eſpecially in the lower region of the *abdomen*, beſides, continual and troubleſome *flatus*'s. About 2 or 3 years before his death he had bilious, purulent, and very fetid ſtools, ſometimes with mucous, and ſometimes bloody clots; and ſo frequent, that very often he would go to ſtool 20 times in 3 or 4 hours, with his *teneſmus* ſtill upon him: At length, there broke out fungous, livid and black caruncles, ſome of which were at leaſt as big as a nutmeg. But however frequent his going to ſtool generally was; yet ſometimes, eſpecially in the height of the diſorder, he would be very coſtive and in exquiſite torture, ſo that

that there was a neceſſity of uſing either clyſters or cathartics. And at times, the patient would, as if ſtarved, greedily devour whatever was given him; and again nauſeate the moſt exquiſite dainties: He became daily more emaciated; his urine was always bilious, and in leſs quantity; and his countenance wan, and often of a yellowiſh caſt. He bore his long and painful illneſs with the greateſt reſolution, till at length an oedematous ſwelling in his feet, a *delirium*, the *facies Hippocratica*, cold and clammy ſweats (the certain preſages of death) came on.

Different preparations of *ipecacuhana* were preſcribed by ſeveral of the moſt ſkillful and celebrated in the whole profeſſion; as emetics, ſtomachics, deobſtruents, incarnatives, balſamics, and all ſorts of adſtringent clyſters; but all were ineffectual, only that *laudanum* gave the patient ſome ſhort relief. The *Briſtol*, *Bath*, *Spaw* and *Pyrmont* waters, and a long continued and exact milk and vegetable diet were all tried to no purpoſe; tho' for a few days he ſometimes would ſeem a little refreſh'd.

Upon opening the *abdomen* we obſerved the *omentum* entirely conſumed and putrid, the liver very much ſwelled, and full of whitiſh, hard, ſcirrhous tubercles; the gall-bladder half full of a blackiſh bile; the whole *duodenum* with the neighbouring part of the *colon* tinged of the ſame colour; the *pancreas* exceeding ſcirrhous, the middle of the *ileum* inflamed for about 5 inches, and almoſt livid: The kidneys were pretty ſound, and the meſenteric glands not ſo ſcirrhous, as we might have expected. But what was moſt remarkable, the upper part of the *colon* (which the ancients improperly called *cœcum*, a name rather applicable to its *appendix*) was not faſtened, as uſual, by means of the vermicular appendix to the right kidney, or rather to the internal *lamina* of the *peritonæum*, which envelopes the kidney; but falling into the *pelvis* about 3 inches below *Tulpius*'s valve, ſtrongly adhered to the upper part or the *rectum*: It moreover ſlightly adher'd to that tunic of the *peritonæum*, that expanded over the bladder; from thence reflected upwards, and forming a very acute angle with the upper part of the inteſtine (if it may be ſo call'd) and then aſcending under the hollow of the liver, and extending itſelf below the bottom of the ſtomach, it deſcended in the uſual manner, and terminated in the *rectum*. Upon our firſt obſerving the inteſtines both above and below the adheſion to be gangrenous, and ſuſpecting that here lay the ſeat of the diſtemper, we began to lay open the *rectum* very cautiouſly and ſlowly; upon which, we obſerved the internal coat ſphacelated, and black, as if tinged with ink, and exceedingly mortified; beſides it had 6 or 7 blackiſh, fungous, caruncles adhering to it, the leaſt of which was as big as a filbert. Upon ſearching farther, we found an ulcer, that penetrated from this inteſtine into the *colon*, at the place where they unite, and into which one's finger could eaſily enter. The inteſtines were ſo mortified, that they could ſcarce bear the gentleſt touch. We obſerved the greater part of the *colon* ſtuffed with harden'd *fæces*, tho' the patient had had ſeveral liquid ſtools a little before he died; the thinner *fæces* paſſing directly thro' the ulcerated orifice into the *rectum*, whilſt the harder remained in the *colon*. The bladder was exceeding flaccid, and lined on the inſide with a reddiſh *mucus*.

From this faithful hiſtory of the diſeaſe, and from what was obſerved upon opening the body, we may eaſily conjecture what was the cauſe of it: For, it is well known from anatomy, that a concretion of the inteſtines with one another, or with the *peritonæum*, does exceedingly impair the periſtaltic motion. Vide *Cowperi Anatom. explic. Tab.* 34. Upon which enſues an exceeding ſlow and weak protruſion of the *fæces* at the place of concretion, a collecting of them together, and a ſtoppage: So that it is probable, that either an inflammation or eroſion of the inteſtine, an ulcer, and at length a gangrene, in a perſon ſo exceedingly cachectic, was occaſioned by hard and ſharp bodies, as plumbſtones; or by acrid and bilious humours, not ſufficiently propelled by the vermicular motion, but ſtopped at the acute angle of the *colon*.

A conjecture concerning the Nature and Manner of forming Saturn's Ring, *the appearing and diſappearing of ſome fixed* Stars; *by M.* Maupertuis. Phil. Tranſ. N° 422. p. 254. *Tranſlated from the* Latin.

THE conſideration of the different figures, which fluids may put on, according to the different ratio of gravity to the centrifugal force, ſuggeſted to M. *Maupertuis*, that probably the planets have ſuch forms; ſince for this there is only neceſſary a ſwifter motion round the axis, or a leſs denſity of matter: For, tho' few planets, that we know of, come ſufficiently near a ſpheroidical figure, why may we not admit of other forms, either about other ſuns, or even our own? Theſe lentiform planets would never be ſeen by us, either by reaſon of their diſtance, or becauſe they would be in the plane of the ecliptic, or in a plane ſomewhat inclined thereto, to which plane their axis of revolution would be perpendicular, or nearly ſo: For, in this ſituation they could not be ſeen from the earth.

And why might not ſuch a variety of forms obtain among the

the fixed ſtars? Eſpecially, ſince it is exceeding probable that they revolve round their axis, like our ſun. There are probably lentiform fixed ſtars in the heavens; and probably they are ſurrounded with very excentric planets, or comets, which, ſince they are not fixed in the plane of the equator, when they approach the perihelion, diſturb the direction of the ſtar's axis; and then the ſtar, which by reaſon of its ſituation does now diſappear, appeared; or that, which appeared before, does now diſappear. And ſo a reaſon might be aſſigned, why ſome ſtars ſeem to appear and diſappear alternately.

But if in any ſyſtem a comet with a tail move near ſome powerful planet, what will be the conſequence? Why, the matter emitted from the body of the comet, will be attracted round the planet; and by the comet's ſending out new matter, or a ſufficient quantity being already emitted, there will ariſe a continual flux of matter round the planet: And tho' the column, emitted from the comet, may at firſt be either of a cylindrical, conical, or any other form, yet its centrifugal force, together with the gravities ariſing both from the planet and from the effluent matter, will always render it broader and thinner; and this incurvated column will approach to ſome of the forms determined in *Prob.* 2. of *Maupert. Diſſert. on the figures of fluids, turning round an axis.* And thus a reaſon might be aſſigned for *Saturn's ring*, the moſt ſurpriſing phenomenon in nature.

And while the tail of the comet would furniſh the planet with ſuch a *ring*, the comet itſelf might probably be attracted, if at a due diſtance, and become a new ſatellite to the planet: And thus probably ſeveral comets have furniſhed out both *Saturn*'s ſatellites and his *ring*: For it is not likely that *Saturn's ring* is owing to the effluvia of one comet, ſince it projects a ſhadow upon *Saturn*'s diſk: whereas the matter of the tails of comets is ſo rare that the ſtars may be ſeen to ſhine thro' it. *Saturn's ring* therefore ſeems to conſiſt of the tails of ſeveral comets, whoſe matter is become more denſe on account of *Saturn*'s attraction.

It is evident that a planet may acquire ſatellites, and yet not a *ring*: For, all comets have not a tail: and if a comet without a tail be attracted, it will furniſh the planet a ſatellite without a *ring*.

The great Sir *Iſaac Newton* has concluded that the vapours of comets are diſperſed among the planets; nay he reckoned this communication neceſſary, in order to repair the loſs of liquid matter. And Dr. *Halley* and Mr. *Whiſton* are of opinion that both comets and their tails, cauſe conſiderable changes in the planets, as the variation of their poles, deluges, and conflagrations; but comets may possibly produce more benign effects; and even sometimes supply the planets with useful and surprising things.

Of the Arcutio; *by Mr.* St. John. Phil. Transf. N° 422. p. 256.

WHEN Mr. *St. John* considers how many are charged overlaid in the bills of mortality, he is surprised that the *arcutio*'s, universally used at *Florence*, are not made use of in *England*.

Fig. 3. Plate VIII. represents one, drawn in perspective, with the dimensions, which are larger than usual; *a* the place where the child lies; *b* the head-board; *c* the hollows for the nurse's breasts; *d* a bar of wood to lean on, when she suckles the child; *e* a small iron arch to support the said bar. The length is 3 feet 2 inches and ½.

Every nurse in *Florence* is obliged to lay the child in it, under pain of excommunication. The *arcutio*, with the child in it, may be safely laid entirely under the bed-cloaths in the winter, without danger of smothering.

An extraordinary large left Horn *of the Stag kind, taken out of the Sea on the Coast of* Lancashire; *by Mr.* Hopkins. Phil. Transf. N° 422. p. 257.

THE dimensions of this horn are exactly set down, as Mr. *Hopkins* took them himself, by laying a string along the surface, *a e* (Fig. 4. Plate VIII.) represents the length, being 30 inches; *b b* the circumference above the third branch, 7 inches; *c* the circumference above the second branch, 8 inches; *d d* the circumference between the brow and second antler, 11 inches; *e e* the circumference 10 inches; *d e* the circumference of the brow-antler, 6 inches and ¾; *e f* the length of the antler, 16 inches ¾.

This horn was drawn out of *Raven's barrow* hole, adjoining to *Holker old Park*, by a fisherman's net, on the 20th of *June* 1727. The tide flows constantly where it was found, and the land is very high near it.

It is now in the possession of Sir *Thomas Lowther* of *Holker* in *Cartmell* in *Lancashire*.

Three extraordinary Cases. 1. *A Child born with the Bowels hanging out of the Belly.* 2. *A Suppression of Urine in a Woman; and* 3. *A Stricture in the Middle of* *of the Stomach, dividing it into two Bags; by Mr.* Claudius Amyand. Phil. Tranf. N° 422. p. 258.

DEC. 18. 1730, a child was born with the greateft part of the bowels hanging out of the belly, thro' an aperture about half an inch in diameter, on the right fide of the navel ftring. The birth was natural and eafy.

Mr. *Amyand* being call'd, found the aperture lined with a fkin, and a ligament that oppofed the reduction; the parts were livid and tending to a mortification; yet the child liv'd near three days.

Upon opening the body, he found the *prolapfus* to confift of all the fmall guts, except the *duodenum*, and of all the large ones, except a fmall portion of the *rectum*: The gall-bladder was about two inches long; one half of which ftood out of the *abdomen*, as alfo a fmall portion of the ftomach: All thefe were coalefced together, and confounded in fuch manner, that it was impoffible to feparate them; tho' upon blowing, the inteftinal tube feemed to have its ufual length. The liver was much thicker and larger than ufual, and convex in that part of it that is naturally concave: And the *uterus* and bladder prefs'd on the left fide, by the weight of the bowels preffing on the right.

The mother could affign no caufe for this preternatural formation. The child came at full time: but its inquietudes for fome months before the birth, made the mother apprehend he was not well.

Mr. *Amyand* was call'd to a woman who had a fuppreffion of urine, occafioned by the *menfes*, collected in the *vagina* preffing upon the *urethra*. She had been delivered eight months before of two children; after which the *carunculæ myrtiformes* had joined together fo clofely, that there was no room for any evacuation of the *menfes*. Mr. *Amyand* made a crofs aperture, whereby near three quarts of the *menfes* collected were difcharged The fuppreffion of urine was immediately remov'd, and the patient cured.

Upon opening the body of a young country girl, dead of a confumption, Mr. *Amyand* found her lungs fuppurated in feveral places, and a ftricture in the middle of the ftomach, dividing it into two bags. This ftricture appeared to have been of fome ftanding, and likely to have occafioned fome difficulty in digeftion. But upon enquiry, her miftrefs and fellow-fervants faid, that her appetite and digeftions were natural; and that fhe had continued in a good plight; till upon coming to *London* fhe contracted a cough, that had brought on the confumption.

An

An Abstract of Meteorological Diaries; with Remarks upon them; by Dr. Derham. Phil. Transf. N°. 423. p. 261.

A Table shewing the Height of the Mercury in the Barometer, the Coast and Strength of the Winds, and the Weather, on the first Day of eight Months in 1707, 1707-8, *observ'd at* Coventry *in* Warwickshire, *by Mr.* Beighton; *and at* Upminster *in* Essex *by Dr.* Derham.

COVENTRY.

Month.	Barom. Inches.	Barom. Decim.	Winds.	Weather.
July.	29.	2 25 4	S^2 SW^3 2	Cloudy with sunshine.
August.		5	W^1 N W 1	Fair sunshine day.
Sept.		15 25	SW^3 4	Rain. High winds.
Octob.		05 05	SW^3	Much rain.
Novem.		85 85	W^1 W^1	Cloudy.
Decem.		05	SW^1	Rain. Warm.
January		05	E^1	Temperate and misty.
Febr.		65	N^2	Clear cold with snow.

UPMINSTER.

Month.	Barom. Inch.	Barom. Cent.	Winds.	Clouds.	Weather.
July.	29.	39 36 52	S^{2} W^{7}	S W S W b W	Showers and ſtormy.
Auguſt		58 51	W b S^{0}		Fair and ſome clouds.
Sept.		33 29 38	S b W^{5} W b S^{8}	S S W	Storms with ſhowers.
Octob.		13 14 14	W S W^{6} 7		Stormy day.
Nov.		81 84 82	N W b W^{1}		Cloudy.
Dec.		21			
Jan.		01 06	N N E^{0}		Cloudy dark day.
Feb.		62 59 52	N N E^{3} 3		Froſt and ſnow with fair.

A Table

A Table shewing the Coasting and Strength of the Winds and the Weather eve[ry] first Day of the Month in 1715, and the Quantity of Rain in that Mont[h] observ'd at Harvard-College *in* Cambridge *in* New England, *by Mr.* Th[o.] Robie; *and the Height of the Mercury in the Barometer, the Coasting a[nd] Strength of the Winds and Clouds, the Weather and Rain at the same Time [at]* Upminster; *by Dr.* Derham.

HARVARD COLLEGE.

Month.	Wind	Rain. Lib.	Rain. Cent	Weather.
Jan.	W N W W b N S	5.	17	
Febr.	S W 1 S W 3 W 0	12.	22	Hazy. Snow. Cloudy.
March.	W 1 S W 1 SWbW 1	5.	14	Hazy. Cloudy.
April.	NWbW 5	12.	71	Snow.
May.	Calm. E 3 E 4	13.	14	Frost. Serene.
June.	S W 2 W N W 0 S W 1	13.	63	
July.	NWbW 2	14.	42	Showery.
August.	N W 0	9.	64	Serene and pleasant.
Sept.	N E 0 E 1 0	Sept. and		Fair.
Octob.		Octob. 30.	78	
Nov.	W 0 N W 1 N 1	7.	24	Fair with cloudy.
Dec.	W 3 W N W 3 W 1	5.	83	Fair and cold.

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Month	Barom.	Winds.	Clouds.	Rain.	Weather.
Jan.	30. 11 10 14	N E 3 2		4. 31	Hardfroſt and cloudy.
Febr.	29. 75 30. 10	W S W 10		3. 7	Stormy.
March.	29. 40 48 40	E N E 3 4		12. 53	Cloudy. Miſling. Rain.
April.	65 60 46	S b W 1 E 3	S	13. 19	Fair with cloudy.
May,	32 39 30	S b E S W 2		4. 66	Rain. Fairer.
June.	69 69 72	N N W 0 N W 2	S W	16. 34	Fair with cloudy.
July.	65 71 77	W 1 N W 1		20, 00	Cloudy. Thunder and Rain.
Anguſt.	30 28 28	N W 0	S W	20. 49	Fog. Rain. Fairer.
Sept.	55	S S W 0		9. 17	Fair. Rain.
Octob.	75 72 50	W S W 0 1		14. 08	Hoar froſt Fair. Rain.
Nov.	54 54 38	S W 0 W b N 1		8. 53	Rain. Cloudy.
Dec.				2. 55	

A Table

A Table of the like Obſervations in 1716, *as thoſe in th* *preceeding Table, except the Rain in* New England, *whic* *Mr.* Robie *omitted.*

HARVARD-COLLEGE.

Month.	Wind.		Weather.
Jan.	N W 2 N W 2		Cold and clear.
Febr.	N W b W 1 N 0 E 0		Cold hard froſt
March.	E 0 N 0 N W 1		Rain. Fairer.
April.	S E 1 N W 6		Cloudy. Fair.
May.	N 0 E 1 S 2		Fair.
June.			Rain.
July.	N W 1 0		Fair and cool.
Auguſt.			
Sept.	S W 2 6 4		Fair and ſome clouds.
Octob.	W 1 S W 2 S 1		Fair. Hoar-froſt.
Nov.	W 2 W N W 1 1		Fair and pleaſant.
Dec.	N 1 N E 2		Cold and raw. Snow.

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Month.	Barom.	Winds.	Cloud.	Rain. Lib.	Rain. Cent.	Weather.
Jan.	29. 62 59 76	W b N o N b W o		8.	61	Thaw wth mifling & cloudy.
Febr.	30. 15 18 21	N N E 2 1		1.	76	Black clouds.
March.	29. 42	W b N o		1.	93	Fair.
April.	85 85 80	E b S 1 E S E	S S	5.	04	Fair and pleafant.
May.	30. 00 29. 97	N 2		9.	52	Fairwarm day.
June.	94 98 30. 01	N N W 1 N b E 4	N N W	8.	24	Cloudy. Rain. Fairer.
July.	29. 91 92 90	N W o W 3	N b E	4.	47	Fair pleafant day.
Auguft.	88 88 92	W N W 1 N W 4	N W	2.	11	Cloudy. Fairer. Cloudy.
Sept,				9.	87	
Octob.	51 52 50	W b S o o		15.	75	Clofe dark day. Rain.
Nov.				4.	41	
Dec.	68 87	N b W 2		7.	16	Froft and fair.

The

The remarks on the foregoing tables are, as follows.

1. Dr. *Derham* obſerves that there is a great agreement between the barometers at *Coventry* and *Upminſter*, in their riſing and falling near the ſame time, at leaſt not many hours before or after one another, and for the moſt part in the ſame proportion; as alſo that when one is ſtationary, the other is ſo too, eſpecially if of any continuance: But at *Coventry* the mercury is lower than at *Upminſter* about a tenth of an inch; the ſituation at *Coventry* being, he ſuppoſes, higher than that of *Upminſter* about 82 feet, according to his experiments in *Phil. Tranſ.* N° 336.

2. He likewiſe obſerves a greater conformity between the winds, than (conſidering the cauſes of their perpetual change) could be imagined: For, tho' they may vary a point or two; yet generally thro' all the 8 years, they tended nearly towards the ſame point of the compaſs, and changed in one place as they did in the other; eſpecially when they blew ſtrongly, or were of ſome continuance. He obſerved, that a ſtorm in one place is ſo in the other; of which the diaries at large give ſeveral inſtances; and in this table of 1707 in *September* and *October*, where Mr. *Beighton* has noted the wind's ſtrength to be 3 and 4, it is about the ſame ſtrength with the Dr's of 5, 6, 7, and 8; the latter taking in more degrees of the ſtrength of the winds than the former does.

3. The Dr. likewiſe obſerves, that the weather in each place is for the moſt part nearly the ſame.

4. He has often obſerved, that the falling of the mercury in dark and cloudy weather betokens rain; but the rain is always preceeded with fair weather: And when the fair comes, the foul is not far off; and this chiefly happens, when the wind is in any of the eaſterly points.

5. In *January* 1706-7 ſeveral were troubled with cuticular eruptions, which itch'd much: After this the meaſles were epidemical till the latter end of *May*.

6. The beginning of this year being very dry, and the weather often cold (as appears by the Dr's tables at large) hay was ſcarce, and became very dear.

7. *July* 8, commonly called the *hot thurſday*, was the hotteſt day that happened ſince he began his meteorological obſervations. A young man working in harveſt harder than ordinary, was overcome with the heat, and died; and divers horſes on the road that day dropped down and died.

8. In

8. In *November* and *December* the air being moiſt, and frequently cold, coughs were epidemical with us.

9. He obſerves that the unſeaſonable froſts in *April* 1708 (particularly *April* 25th and 26th) blaſted the tender young leaves and catkins of the oak, walnut-tree, *&c.* which he takes to be the reaſon that there were but few acorns and walnuts that year. Whence it may juſtly be concluded, that the catkins are of greateſt uſe to the fertility of ſuch trees that bear them; but whether as a male *ſperma* he does not determine.

10. This month of *April* horſes were likewiſe every where ſeiſed with dangerous coughs, of which ſeveral died in *London*, and other places, eſpecially ſuch as labour'd on the roads. The Dr. has great reaſon to think theſe colds were catching; becauſe his horſes that went well to *London* returned with great and ſudden colds.

11. *June* 11, (tho' the day of the ſummer ſolſtice) was followed by a very cold night, his thermometer deſcending nearly to the point of hoar-froſt.

At Dr. *Derham*'s requeſt the late ingenious Mr. *Robie* made in 1715, *&c.* to the end of 1722 meteorological obſervations (of which the foregoing is an extract, and with which he joined ſome obſervations of his own, which tally with them) in *New-England*, morning, noon and night, to correſpond with the Dr's at the ſame time at *Upminſter*.

Mr. *Robie*'s obſervations want thoſe of the barometer and thermometer; neither of which inſtruments could be gotten in *New-England*. Could we have had thoſe obſervations, they would have been of great uſe in ſeveral phenomena of thoſe diſtant places, which now can only be gueſſed at: And,

1. That tho' *Harvard-College* is 10 degrees more ſouth than *Upminſter* (it being as Mr. *Robie* ſays in Lat. 42 deg. 25′ north, and Long. from *London* 4^h 44′, as corrected by the beſt obſervations) they have as cold, if not colder ſeaſons than we have here.

2. Tho' the ordinary agreement or diſagreement of the winds deſerves no remark; yet it may deſerve obſervation, that when the winds have continued long in one point, they have nearly agreed in both places, and eſpecially, when they have been high, and ſtrong for ſome time. In which caſe the Dr. has obſerved that there have been ſome days difference in the coming of thoſe winds; as if there were ſo many days in their paſſage from place to place.

And

And this agreement of the winds, together with that of the afcent and defcent of the mercury before-mentioned, divers curious obfervers have taken notice of, as well as the Dr. between diftant places, tho' not fo far as *New-England*; as at *Zurich*, *Paris*, *Lancafhire* and *Upminfter*; as may be feen in the *Philofophical Tranfactions*, particularly N° 208, 286, 297, 321.

3. The Dr. obferves, that they have in *New-England* many more *parhelia*, *halo's*, *lunar rain-bows*, and fuch like appearances; as alfo more *earthquakes*, *unufual meteors*, *thunder and lightning* than we have.

4. The rain in 1715 (which was the only year in which Mr. *Robie* obferved it) in the different months, amounted to different quantities; but in the whole year, it was nearly the fame as at *Upminfter*; that at *Harvard-College* being 130, 64 *lb.* that at *Upminfter* 128, 92 *lb.* But confidering that Mr. *Robie*'s tunnel, that received his rain, was but 11 inches and ½ in diameter, and the Dr's exactly 12; the proportion, therefore, of the *New-England* rain may be accounted fomewhat the greater.

5. The Dr. obferved at *Upminfter*, that in *January* the contagion, which was very fatal among the black cattle about *London* the latter end of the laft year, came among us and deftroy'd feveral.

In *March* many were afflicted with head-aches; and the fmall-pox was epidemical: And the earth being very dry, the ponds empty and the fprings low, in that and the next month there fell good ftore of feafonable rain, as the table for that year fhews, but not fufficient to fill the ponds. But in *June*, *July* and *Auguft* more rain fell than was wanted; which filled the ponds, but injured the hay and corn, and made the roads as dirty as in winter.

In the fummer of this year the Dr. had feveral confirmations of fome former obfervations in his phyfico-theology *lib.* 1. *c.* 3. viz. *that a cold fummer is commonly a wet one*; which this fummer was, the fpirits in the thermometer being often low, particularly near the point of hoar froft on *Aug.* 12.

In *January* the following year, *viz.* 1716, the river of *Thames* was frozen for feveral miles; and in particular fo intenfely at *London*, that whole ftreets of booths were erected on the ice, oxen roafted, coaches driven, and feveral diverfions exercifed above bridge: And fo ftrong was the ice below bridge, that people walked and fkated at pleafure thereon. But yet the

fpirits

ſpirits in the thermometer deſcended not all the while ſo low, as on *Dec.* 30, 1708.

In *Scotland* likewiſe (which in 1708-9 felt but little of that year's ſevere froſt) the ice was ſtrong enough to bear the horſe and foot of the armies.

And beyond ſea they ſuffer'd much; particularly in *Spain*, a great deal of damage was done by the wild beaſts, which were forced by the froſt out of the woods.

Among birds, the goldfinches ſuffered much, having ſcarce obſerved one of them all the following part of the year; they being killed by the hard weather, or driven to ſeek food in other parts.

On the —— day of —— the wind was ſo violent, that the *Thames* was emptied from *London-bridge*, as far as ——; ſo that only a ſmall rivulet of water, no bigger than a brook of 10 or 12 foot over, remained: Inſomuch that people walked on the bottom, and found treaſure there.

In *November* and *December* pleuriſies were frequent, and mortal in our parts of *Eſſex*. The weather was mild, open, dark, and damp for the moſt part, with now and then a cold day or two.

Mr. *Robie* farther remarks, that on *Feb.* 12, 1715-6 there had been an earthquake at *Salem* village; and on *October* 21 following, the day was ſo dark, that people were obliged to light candles to eat their dinners by; which could not be owing to an eclipſe, the ſolar eclipſe having been the 4th of that month.

On *February* 13, 1716-7, Mr. *Robie* obſerved an immerſion of *Jupiter*'s firſt ſatellite, at $10^h\ 48'\ 17''$; and on *February* 8, Dr. *Derham* obſerved an emerſion at $8^h\ 7'\ 30''$; according to which the difference of longitude between *Harvard* college and *Upminſter*, is $4^h\ 45'$; and Mr. *Robie* ſays, that by the lateſt and beſt obſervations it is $4^h\ 44'$ from *London*.

Sep. 23, 1717, Mr. *Robie* obſerved a ſolar eclipſe.

	h	′	
The beginning at	12	23	
The middle at	1	47,	or thereabouts.
The end at	3	5	10″ *p. m.*

About 9 digits were eclipſed.

October 5 following, he obſerved the ſouthing of the moon at $9^h\ 32'$ *p. m.*

On

On *Feb.* 25, 1717-8, Mr. *Robie* ſaw the moon cover *Aldebaran* at about $9^h\ 18'$ *p. m.* and the ſtar to emerge at $10^h\ 20'$ *p. m.* by his meridian inſtrument (ſuch as Dr. *Derham* has deſcribed in *Phil. Tranſ.* N° 291) being 2′ too ſlow; ſo that 2′ are to be added to the time mentioned.

March 10, 1717-8, Mr. *Robie* obſerved an emerſion of the firſt *Circumjovial* at $10^h\ 45'\ 35''$.

Sep. 24, 1718, Mr. *Robie* obſerved the moon to ſouth at $9^h\ 38'$, or thereabouts: On the 25th at $10^h\ 22'\ 32''$, *p. m.* On the 26th at $11^h\ 26'$ *p. m.*

December 5, a great fiery meteor was ſeen in the morning about break of day. And on the 9, about ½ an hour after 10, in the S. S. W. he obſerved another, which diffuſed a light like the moon.

Dec. 19, the moon ſouth'd at $6^h\ 45'\ 45''$ *p. m.* On the 20. at $7^h\ 30'\ 56''$. On the 23. at $9^h\ 54'\ 5''$. On the 25, at $11^h\ 47'\ 33''$.

Jan. 13, 1718-9, the firſt *Circumjovial* immerged at $10^h\ 35'$ *p. m.*

Jan. 17, the moon ſouth'd at $5^h\ 52'\ 1''$. On the 19, at $7^h\ 33'\ 1''$. On the 22, at $10^h\ 21'\ 40''$ *p. m.*

Feb. 16, the moon ſouth'd at $6^h\ 15'\ 15''$. On the 19, at $8^h\ 59'\ 40''$. On the 21, at $10^h\ 54'\ 30''$ *p. m.*

Dec. 11, 1719, a very unuſual meteor was obſerved in the evening.

Jan. 8, 1719-20, Mr. *Robie* ſays there was an earthquake.

Nov. 24, 1720, Mr. *Robie* obſerved a ſtreaming from the northern horizon; as Dr. *Derham* had done on *Nov.* 22, before.

Dec. 10, 1720, about 8^h *p. m.* Mr. *Robie* firſt ſaw the light that ſtrikes up towards the *Pleiades*; and on *Jan.* 6, following, he found it was increaſed, and almoſt reach'd to the *Pleiades.* And *Dec.* 7, 1721, he obſerved the ſame; and on the 25th he hath given this figure of it; *ho* (Fig. 5. Plate VIII.) repreſents the part next the horizon; V the point towards the *Pleiades.*

This glade of light is the ſame that Dr. *Childrey* mentions in his *Briton. Bacon.* under the name of *ſemita luminoſa*; and which Dr. *Derham* obſerved, and gave a figure of in *Phil. Tranſ.* N° 305.

Mr. *Robie* made the following obſervations of the eclipſe of the moon *June* 28, 1721.

About

About 2 o'clock in the morning he reviewed the moon with his 8 foot teleſcope, and ſhe was untouch'd.

Correct time.			
h	′	″	
2	10	0	A thin *penumbra.*
2	12	0	the ſhadow plainly enter'd.
2	18	10	*Palus Mareotis* cover'd.
2	31	40	*Mons porphyritis* touch'd.
2	34	20	——————— cover'd.
2	47	10	The moon eclipſed about 6 digits.
2	49	5	*Besbicus* juſt touch'd.
2	50	30	——— entirely cover'd.
2	53	40	*Byzantium* touch'd.
2	54	10	———— cover'd.
3	5	40	*Palus Mæotis* touch'd.
3	18	30	The moon entirely cover'd.

There remained a light on the weſtern ſide of the moon for ſome time.

About 3^h 50′ in the morning the moon was entirely hid by the haze, and the coming on of day-light, that nothing could be ſeen of her; tho' from the immerſion till now ſhe was viſible.

The obſervations of Mr. *Robie* made on the ſolar eclipſe *Nov.* 27, 1722, are as follows.

h	′	″	
7	27	0	He ſaw the ſun riſe eclipſed about 4 digits or his ſupreme vertex; the greateſt part of the ſhadow lay to the S. W.
			Then we could obſerve no more till
8	30	0	The ſun began to appear; and 6 digits, or thereabouts were eclipſed.
8	55	15	The ſun was eclipſed 4 dig. ¾ nearly; and then the ſun's diameter was to the moon's, as 1000 to 972.
9	0	15	4 dig. and ½ were hid nearly; and the ſun's diameter was to the moon's, as 1000 to 975.
9	19	45	A little ſpot on the ſun emerged.
9	25	45	He ſaw the moon go off the ſun; as did alſo Mr. *Danforth* at the ſame time; and Mr. *Appleton* at
9	25	20	

 The

The Description of a new Quadrant *for taking Altitudes without a Horizon, either at Sea or Land, invented by Mr.* John Elton. Phil. Transf. N° 433. p. 273.

THIS instrument (Fig. 6. Plate VIII.) contain 4 principal parts, *viz.* a frame, an index, a label, and a shield; and these consist of several parts.

The frame A B C D E F has two parts; one a graduated arch DE of 30 degrees; each degree being subdivided into 6 equal parts; the other a chord BC of an arch of 60°, divided into 2 equal parts (at the extremities and in the middle of which are 3 holes or stops *a b c* for the label) together making 90°, or a quadrant. The index GH turns upon the centre of the frame the whole compass of the arch, and has 3 parts; *viz.* a *Nonius* plate *n*, an eye-vane *v*, and a tube *t.* The *Nonius* plate moves with the index, and subdivides each of the small divisions of the arch into 10 equal parts or minutes: The eye-vane is to look thro' in forward observations. The tube is to shew, when the index is horizontal. The label IK moves upon the centre of the frame the whole compass of the chord of the arch of 60 degrees, having 3 fixed stations thereon, at 30, 60 and 90°, and contains 2 principal parts, *viz.* a lens *l*, and a lanthorn whose stool is *o*. The *lens* is to form the sun's image upon the shield. The lanthorn is necessary in nocturnal observations. The shield or ray-plate *dfg* is fixed in the centre of the frame, and consists of 3 parts, *viz.* an azimuth tube *z*, an horizontal tube *h*, and an axis *x*, or in backward observations a ray-plate. The hole in the shield is to receive the sun's image. The azimuth tube is to direct the plane of the instrument perpendicular. The horizontal tube is to shew when the label is level. The axis is to cut the object in forward observations.

A rule for either backward or forward observations.

If the altitude do not exceed 30°, the label must be placed at the station on the radius or longest limb of the quadrant; if the altitude be between 30 and 60°, at the middle station; and if the altitude exceed 60°, at the uppermost station.

To take the sun's altitude by a backward observation.

This is done without using the sight vane, or horizontal tube on the shield. Hold the quadrant with both hands in such a manner, as is aptest for keeping it steady, the back of the arch being turned towards the sun. When the bubble of the azimuth tube is brought under the hole in the shield, cause the sun's image to fall on the hole in the shield; so that it may rest in the

the centre of the ſun's image: The inſtant the azimuth tube and ſun's image are thus regulated, ſee if the bubble in the horizontal tube on the index (which till then is not regarded) leave the open end of the tube, or ſtop any where clear of the ends of the tube: If theſe happen at the ſame time, the altitude is then truly taken: But if the bubble had remained in the incloſed end of the tube, when the azimuth bubble and the ſun's image were regulated, the index muſt have been ſlid up; and if it tarried in the open end, mov'd down, till the horizontal bubble on the index quit the open end of the tube, or ſtop between the ends as was before obſerved; and then is the quadrant ſet. In continuing the obſervation for a meridian altitude, the quadrant being ſet, as the ſun riſes, the horizontal bubble on the index will not quit the open end of the tube, or ſtop between the ends, but hang there, or leave it after the azimuth bubble and the ſun's image have been regulated; which will require the index to be continually mov'd down, in order to keep the quadrant ſet. When the ſun is up, or on the meridian, the quadrant will remain ſet for ſome time; and on the ſun's falling, the horizontal bubble will have a reverſe tendency, inclining or running wholly to the incloſed end of the tube.

To take the altitude of the ſun or ſtars by a forward obſervation.

In this method, the *lens* and tube on the index are diſregarded: Hold the quadrant vertical, and looking thro' the eye-vane, direct the axis, or upper edge of the ſhield to the ſun or ſtar; if the axis cut the ſun or ſtar at the ſame inſtant that the bubble in the horizontal tube on the ſhield quit the open end, the altitude is then truly taken, and the quadrant ſet. But if it ſhould leave the open end of the tube before the axis or upper edge of the ſhield cut the ſun or ſtar, then the eye-vane (or which is the ſame, the index) muſt be ſlid down; and if it remain at the open end, or quit it when the axis is above the ſun or ſtar, moved up till the quadrant be ſet. In continuing the obſervation for a meridian altitude, as the ſun or ſtar riſes, the bubble in the horizontal tube will always quit the open end of the tube before the axis cut the object: So that to keep the quadrant ſet, the eye-vane muſt on every ſuch alteration, be conſtantly mov'd down; while the ſun or ſtar is in the meridian, the quadrant will remain ſet; and when the ſun or ſtar falls, the bubble will act contrary to what it did in the riſing, reſting wholly in the open end of the tube.

To take the ſun's altitude with the horizon.

Turn the back of the arch towards the ſun, and cauſe the ſun's image to fall on the hole in the ſhield, at the ſame time looking thro' the eye-vane, cut the horizon with the axis.

N. B. In taking the altitude of the ſtars, a ſmall light muſt be fixed in the lanthorn; the leſs the better. It will be beſt in forward obſervations of the ſun, to take the altitude of the upper limb, allowing for the ſemi-diameter; and when the ſun is very clear, take his altitude by a backward obſervation, the forward method being chiefly intended for nocturnal obſervations, and when the ſun is too much obſcured to give any ſhadow or image.

There was at the ſame time laid before the *Society* an extract made by Mr. *Elton* of obſervations of the latitude from the journal of Captain *Walter Hoxton*, Commander of the ſhip *Baltimore* from the river of *Thames* to *Maryland* on the continent of *America*, both with *Davis*'s, or the common, quadrant with the horizon, and with Mr. *Elton*'s, a new invented quadrant, without the horizon, A. D. 1730.

From this extract it is obſervable, that in moderate weather the difference of the obſervations, made with the two ſorts of quadrants, was commonly no more than 1′; with ſtrong gales, a large ſea, and in fair weather 5′; in hard ſqualls, the ſea running high 6′; in eaſy gales 9′; in fair weather and a large ſwell 16′; once in ſmooth water 16′; and with freſh gales the greateſt difference of all was 21′; and this difference was conſtantly found to give the latitude more northerly by Mr. *Elton*'s quadrant than by Mr. *Davis*'s; as in this laſt mentioned inſtance the latitude appears to be 35° 39′ N. by *Davis*'s, when Mr. *Elton*'s makes it 36° N.

There is a note added by Captain *Hoxton* at the end of this journal, *viz.* that the difference at different times between *Davis*'s and *Elton*'s quadrants is occaſioned by ſhifting the ſhade-vane of *Davis*'s.

To this journal were annex'd ſome obſervations of the latitude by the fixed ſtars in the foreſaid voyage by Mr. *Elton's* quadrant without uſing the horizon.

Theſe obſervations are generally taken from two ſtars, and the latitude calculated from each obſervation: And ſo they are found to agree commonly within 4 or 5′. The greateſt difference aroſe once to 13′. When by an obſervation taken by *Syrius*, the latitude was found to be

42° 46′	By *Procyon* 42° 56′ N.
Course inter.	
Obſ. S. S. W.	Where the difference is 13′ N.
S. 3′ ½ 0° 3′	
42° 43′	

Captain *Hoxton*, when at anchor in *Cheſea-Peak* bay, found he latitude 37° 29′ N. Off *Cedar point* in *Potuxon* river 8° 7′ N. Off *Cape Henry* 37° 6′ N. And in a letter to Mr. *Eaton* he declares, 'that he obſerv'd with his quadrant both by the ſun and ſtars, in all the various ſorts of weather he met with in his voyage to and from *Maryland*, without regarding the horizon with as great exactneſs, as with *Davis*'s quadrant, when the ſun and horizon were clear.'

There was likewiſe put into the hands of the publiſher, nother letter from one Mr. *John Walton* to Mr. *Elton*, containing ſome obſervations of the latitude in *Leghorn* road, nd ſeveral of the ports of *Spain*, which were found, after epeated experiments, exactly to agree with the known atitudes of thoſe places: Mr. *Walton* adds, that he made everal obſervations in his paſſage home, in hard gales, and great ſea, and when it was ſo hazy, that the common uadrant was of no uſe, for want of a horizon.

A remakable caſe of a Hydrops Ovarii, by Mr. *John Belchier* Phil. Tranſ. N° 423. p. 279.

IN 1725, the wife of one Mr. *Newberry* complained of a pain in her left ſide internally near her groin, which ſenſibly ncreaſed; and perceiving a ſwelling in that part, ſhe at firſt hought herſelf with child; but having other ſymptoms, not very common with women in ſuch a caſe, ſhe ſent for a hyſician, who immediately diſcovered it to be hydropical; and after following his preſcriptions for ſome time, and inding little or no benefit thereby, ſhe ſent for another, and ſo or a third and fourth; and after between two and three years ruitleſs tryal of proper medicines preſcribed by the phyſicians, he growing now very big and uneaſy with her burden was adiſed to be tapp'd, to which ſhe accordingly ſubmitted: And n *May* 1728, ſent for Mr. *Cheſelden*, who took from her beween four and five gallons of water; but in a week or ten ays after the operation, ſhe perceived herſelf to fill again, in which ſtate ſhe continued to the firſt of *July* following, when Mr.

Mr. *Chefelden* tapped her again, and took from her about the fame quantity of water as before; and in this manner fhe continued to fill, and to be tapped every third or fourth week, from the 6th of *May* 1728, to the 3d of *March* 1731-2. when fhe died, in the 33d year of her age.

During the laft 37 times of her tapping, Mr. *Belchier* conftantly attended the patient with Mr. *Chefelden*; when fhe always (till the two laft times) appeared very brifk and lively, the whole time of the water's running from her; and was not in the leaft fick or faint, after the difcharge of the water as is ufual; and tho' fhe was a very thin emaciated woman, fhe would frequently walk two or three miles the day before the operation; and moft commonly go abroad the third day after it.

The quantity of water taken from her each time of tapping, was between 4 and 5 gallons; and during the whole 37 times fhe was tapped, there never was above a quart, or two quarts at moft, difference in the quantity, till the two laft times, at each of which the quantity did not exceed two gallons: But in the intervals of thefe two laft operations fhe was troubled with reachings to vomit, which burft open the orifice twice where fhe was tapp'd, and at each time fhe difcharged about fix quarts. The quantity of water, which was taken from her each time, was always meafured; and upon computation the whole amounts to near 250 gallons. The water that was taken from her the two laft times of tapping, was much more vifcid than the former.

At times fhe frequently complained of a violent pain on her right fide, and a heavy aching pain in the *pelvis*. She had likewife a *prolapfus uteri*; and fome time before her death fhe could not expel her *fæces* but with great difficuly and pain; and at the fame time fhe laboured under an incontinency of urine.

March 6. 1731-2. Mr. *Belchier* opened her in the prefence of her phyfician; when he found the whole *vifcera*, from the diaphragm to the *Offa pubis*, cover'd with a thick gelatinous fubftance, which feem'd to be membranous, and which at its firft appearance, he took for the *omentum* in a putrefied ftate; but after a further examination he found it to be only the more vifcid parts of the extravafated fluid, which could not be difcharged by the operation: After removing this, he found feveral portions of a hard fcirrhous fubftance, arifing from the bottom of the ftomach; one large portion of which was in-

ferted

erted into that part of the *colon*, near the right kidney, and in appearance resembled the pancreatic gland; another portion which was cylindrical, and about $\frac{2}{3}$ of an inch in diameter, passed straight over the intestines, adhering strongly to that part of the *colon*, which lies under the stomach, and was inserted into the *rectum*, in the pelvis; another portion of this substance passed directly over the intestines, to the pelvis; but about the middle of the *abdomen*, it sent out two smaller portions; the one was inserted into the mesentery; the other reflecting back was inserted into the *colon*, on the left side near the stomach. As soon as he cut into one of these portions, he discovered it to be a part of the *omentum* twisted up, and contained in a very thick capsular membrance. The diaphragm was forced up so far by the contents of the *abdomen*, that the cavity of the *thorax* was decreased to near $\frac{1}{3}$. The liver was much larger than in a natural state, and of one entire substance; and not divided into lobes, the whole convex surface adhering firmly to the diaphragm. The stomach, as to its cavity, was very small; but its coats were increased to six times their natural thickness, (as were likewise all the coats of the intestines and mesentery) and very much inflamed. Two thirds of the stomach adhered to that parts of the diaphragm, which did not cover the liver; and the other part adhered to the concave surface of the liver, as did likewise the *duodenum*, whose cavity was very large. Below the *duodenum*, the colon adhered to the lower part of the concave surface of the liver; so that the whole liver was contained in a kind of purse, composed of the diaphragm, stomach, *duodenum*, and *colon*. The *cœcum*, *colon*, and *rectum* were much larger than in a natural state; and adhered so very strongly to the parts over which they passed, that it was with much difficulty Mr. *Belchier* could separate them. The spleen was not one fourth of its natural size, and one half of its external surface was entirely cartilaginous. The *pancreas* was smaller than usual, as were likewise the kidneys, *ureters* and bladder; and in the *pelvis* of each kidney, there were small sabulous concretions. The left *ovarium* was distended to so large a size, as to fill the whole cavity of the *pelvis* up to the *os pubis*; its surface was cartilaginous, like that of the spleen, and in it were contained a great number of *Hydatides* of different sizes, whereas the right *ovary* was no ways diseased in the least. The difficulty and pain complained of in the expulsion of the *fæces*, naturally arise from the pressures on the diseased *ovarium*, at the

same

ſame time that its increaſed bulk, by compreſſing the *inteſtinum rectum* impeded the egreſs of the *fæces*, and brought on the inflammation of the inteſtines which we obſerv'd.

The *prolapſus uteri*, and the incapacity of the bladder's retaining a proper quantity of urine, were likewiſe occaſioned by the preſſure of this diſeaſed *ovarium* upon thoſe parts. But what ſeems moſt material in this caſe, is the viſcid matter found in the cavity of the *abdomen*; as the waters were originally incyſted in the *ovary*, it was properly extravaſated from the *cyſtis*, into the *abdomen* in the two laſt operations; by which, as well the quantity drawn off as the cuſtomary relief, were very much diminiſhed; in lieu of which the *ſtimulus*, from ſuch a fluid, might reaſonably bring on the vomiting obſerved from that time.

Quær. Therefore, if ſuch a vomiting enſuing the operation is not a fatal ſymptom?

Quær. If any method can be found to prevent ſuch extravaſations?

The relations of this gentlewoman are of opinion, that her diſeaſe was occaſioned by pulling off her cloaths, when ſhe was very hot, to go into a bathing-tub of water to cool her; when finding the water exceſſive cold, ſhe put only her legs in, the other part of her body being out of the water, and naked at the ſame time; which happened a few weeks before ſhe perceived the ſwelling and pain in her *pelvis*; and probably this might be the cauſe. As the conſtriction of the lower parts by the cold water might, in a great meaſure, impede the fluids circulating thro' the lower parts, and the blood being at the ſame time rarified and expanded by the heat, might therefore burſt thro' the more tender lymphatics, and produce the extravaſation.

Farther Experiments concerning Electricity; *by Mr.* Stephen Gray. Phil. Tranſ. N° 423. p. 285.

IN *Phil. Tranſ.* N° 422. p. 227, Mr. *Gray* gave an account of experiments, which ſhew that water will be attracted by electric bodies, and that it may have an electric virtue communicated to it, ſo as to attract ſolid bodies; and ſince that time he has been upon another enquiry; namely, whether there might not be a way found to make this property of electrical attraction more permanent in bodies? How far he has ſucceeded in this attempt will appear by the experiments on the ſeveral bodies mentioned in the following catalogue;

PLATE. IX.

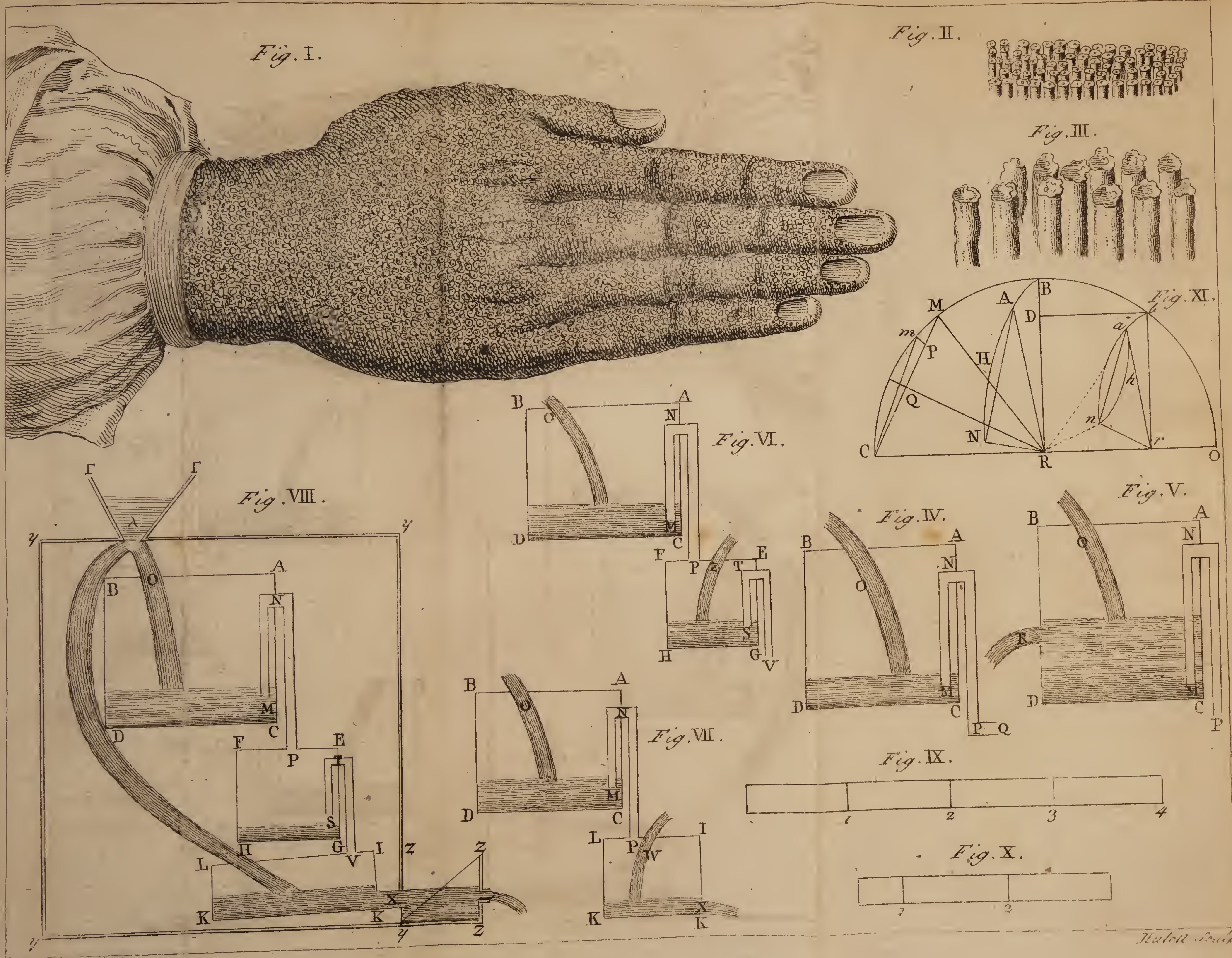
Fig. I.
Fig. II.
Fig. III.
Fig. IV.
Fig. V.
Fig. VI.
Fig. VII.
Fig. VIII.
Fig. IX.
Fig. X.
Fig. XI.
B O A N M C D
F P E T S G V H
L I W X K
y Z
1 2 3 4
M m P Q C N H A B D a h n r R O

catalogue; and as they were all of them prepared in the ſame manner, except N° 18 and 19, which ſhall be deſcribed afterwards, a general deſcription of the method of preparing and preſerving them in a ſtate of attraction, may ſuffice.

The bodies, on which the experiments were made, were roſin, both black and white, ſtone-pitch, ſhell or gum-lac, bees-wax and ſulphur. He procured three iron ladles of ſeveral ſizes, in which he melted theſe ſubſtances, making uſe of that which he thought moſt convenient for the quantity he deſign'd to melt. When any of theſe bodies were melted, they were taken off the fire, and ſet by in the ladle to cool and harden; then it was returned to the fire, where it remained till it was melted about the bottom and ſides of the ladle; ſo as to be moveable, and by inverting the ladle, it might be taken out, having the form of the ſection of a ſphere nearly; the convex ſurface, as alſo the plain one, being naturally (ſo to ſpeak) poliſh'd, excepting the ſulphur, which cools without retaining its poliſh, except when caſt in glaſs-veſſels; as ſhall be ſhewn anon. He now proceeds to the experiments and obſervations made on thoſe electric bodies.

When any of them were taken out of the ladle, and their convex ſurface hardened, they would not at firſt attract, till the heat were abated, or till they came to a certain degree of warmth; and then there was a ſmall attraction. He eſtimated the warmth to be nearly that of a hen's egg, when juſt laid: The attraction increaſing in ſuch a manner, as when cold, to attract at leaſt 10 times farther than at firſt.

The manner of preſerving them in a ſtate of attraction was, by wrapping them up in any thing that would keep them from the external air; as at firſt for the ſmaller bodies he made uſe of white paper, but for the larger ones white flannel; But afterwards he found that black worſted ſtockings would do as well. Being thus cloath'd, they were put into a large fir-box, there to remain till he had occaſion to make uſe of them.

The cylinder of ſulphur N° 18 was made by melting the ſulphur, and pouring it into a cylindric glaſs veſſel, which firſt had been heated to prevent its cracking. When the ſulphur was hardened, it was ſomewhat leſs than the glaſs; ſo that by inverting the glaſs, the ſulphur came eaſily out, and had a poliſh'd ſurface almoſt as ſmooth as the glaſs in which it was caſt. The large cone of ſulphur N° 19. was made after the ſame manner; *viz.* by being caſt in a large drinking glaſs.

He comes now to give an account of the obſervations made on the ſeveral bodies, mentioned in the catalogue; but firſt he gives a deſcription of the catalogue. The firſt column contains the number, which in a ſmall piece of paper is fixed on each of the ſeveral bodies; the name of which is given in the ſecond column, whether they be ſimple or compound ſubſtances. The third column ſhews what weight they were of when melted, in ounces and drachms *Averdupois*. In the fourth column you have the days of the month, when the body was melted, and received its form; and conſequently, when it firſt began to attract.

For 30 days he continued to obſerve every one of theſe bodies, and found that at the end of the ſaid time they attracted as vigorouſly as on the firſt or ſecond day. By the times, mentioned in the catalogue, being ſubſtracted from any time after, will be ſhewn how long any of the bodies have continued their attractive virtue; by which it will appear, that ſome of them have not loſt their attraction for more than four months: So that we have ſome reaſon to believe, that we have now diſcover'd that there is a perpetual attractive power in all electric bodies, without exciting them either by rubbing, heating, &c. or any other attrition. But this will farther appear by the account Mr. *Gray* is going to give of the two laſt bodies, mentioned in the catalogue. The cone of ſulphur N° 19. that was caſt in a large drinking glaſs, in about two hours after it was taken out of the glaſs, attracted, as likewiſe did the glaſs, but at a ſmall diſtance. Next day the ſulphur was taken out of the glaſs; and then it attracted ſtrongly, but there was now no perceivable attraction of the glaſs. Then the cone of ſulphur was ſet with its baſe upon the lid of the fir-box, wherein the other electric bodies lay, and the glaſs whelmed over it. He examined it every day after, and ſtill found it to attract; but finding the place not ſo convenient, having occaſion to look into the box often, he removed it to the table that ſtands between the two windows of his chamber, where it has continued to this time; and whenever the glaſs is taken off, attracts at near as great a diſtance as the ſulphur that is cloathed and ſhut up in the box above mentioned. And tho' at firſt there was no attraction, when the glaſs was taken off; yet he now finds, that in fair weather the glaſs alſo attracts, but not at ſo great a diſtance as the ſulphur, which never fails to attract, let the wind or weather be never ſo variable, as do all the other bodies

bodies mentioned in the catalogue; only in wet weather the attractions are not made at ſo great a diſtance as in fair weather.

N° 20 is a cake of ſulphur that was melted; and as the other bodies have taken the form of a convex ſection of a ſphere, this when cold, was laid with its flat ſide downwards, on the ſame table with the cone of ſulphur: They were both placed ſo near the wall, as to prevent the ſun ſhining on them. This was, as the catalogue ſhews, on the 18th of *April*; and, though it had no manner of cloathing or covering, has attracted ever ſince. And in this, as in the other bodies, the attraction will be according to the weather; but when it attracts the ſtrongeſt, it is not more than the tenth part of what the cone of ſulphur, that is covered, attracts.

The manner of obſerving theſe attractions is beſt performed by holding the attracting body in one hand, and a fine white thread tied to the end of a ſtick, in the other; by this means far leſs degrees of attraction will be perceived, than by making uſe of leaf-braſs. When the thread was held at the utmoſt diſtance, it may be attracted; the motion of it is at firſt very ſlow, but ſtill accelerating as it approaches nearer to the attracting body.

With a ſmall hand air-pump he made experiments on ſeveral bodies, and finds that they will attract *in vacuo*, and that at very nearly the ſame diſtance as *in pleno*, provided that the experiment be made in the ſame receiver, filled with air; as will appear by the following experiments.

There was taken a hollow glaſs ſphere, of ſomewhat more than two inches and a half in diameter; being firſt excited, it was ſuſpended by a loop of ſilk that went thro' a ſmall cork, with which the hole in the glaſs ball, by which it was blown, was ſtopped; and by the loop ſuſpended on a ſmall hook, that was ſcrew'd on to the braſs wire, that came thro' the collar of leather in the braſs plate, that covered the top of the open receiver, as in the experiment of letting fall the guinea and feather *in vacuo*: Then the ball was drawn up to the top of the receiver, and the top of the ſmall ſtand, covered with paper, was laid on the wet leather on the plate of the pump, and leaf-braſs, laid on the ſame: Then the air was exhauſted; when the glaſs-ball was let down to about an inch, or ſomewhat more, towards the pieces of leaf-braſs, ſeveral of them were attracted by it. Then the air was let into the receiver, and the leaf-braſs laid on the ſtand, the ball, being ſuſpended as before, was let down to about the ſame diſtance from the leaf-braſs as before, and there ſeemed to be very little difference in the attraction.

He made the ſame experiments with ſulphur, ſhell-lac, roſin, and white bees-wax. Theſe would be attracted to the height of an inch and a half by eſtimation; and when the experiment was made with the receiver full of air, there was very little, if any, difference in the height of the attraction, when there was the ſame time ſpent before the attraction was begun *in pleno*, as there was required to exhauſt the receiver.

A catalogue of the ſeveral electric bodies mentioned above.

N°	Names of the ſeveral bodies	wt. oz.	dr.	mon.	days
1	Fine black roſin	2	0	*Jan.*	31
2	Stone-pitch and black roſin	2	2	*Jan.*	31
3	Fine roſin and bees-wax	2	1	*Feb.*	11
4	Stone-pitch	1	7	*Feb.*	11
5	Stone ſulphur	3	6	*Feb.*	4
6	Shell-lac	10	0	*Feb.*	10
7	Fine black roſin	10	4	*Feb.*	11
8	Bees-wax and roſin	9	0	*Feb.*	12
9	Roſin 4 parts and gum-lac 1 part	10	0	*Feb.*	12
10	Sulphur	18	0	*Feb.*	15
11	Stone-pitch	10	12	*Feb.*	16
12	Black roſin	23	0	*Feb.*	2[illegible]
13	White roſin	7	12	*Feb.*	2[illegible]
14	Gum-lac	11	14	*Feb.*	2[illegible]
15	Gum-lac and black roſin equal parts	9	12	*Feb.*	2[illegible]
16	Gum-lac 4 parts, roſin 1 part	17	8	*Feb.*	2[illegible]
17	Shell-lac and fine black roſin equal parts	28	4	*Mar.*	[illegible]
18	A cylinder of ſtone ſulphur	19	4	*Mar.*	2[illegible]
19	A large cone of ſtone ſulphur	30	0	*Mar.*	2[illegible]
20	A cake of ſulphur	11	4	*Apr.*	2[illegible]

An Experiment to ſhew that the Friction of the ſeveral Parts in a compound Engine may be reduced to Calculation; by drawing conſequences from ſome Experiments upon ſimple Machines *in various Circumſtances; by Dr.* Deſaguliers. Phil. Tranſ. N° 423. p. 292.

THE machine conſiſts of 3 pullies (2 upper and 1 lower, or a tackle of 3 pullies) whoſe diameters are exactly as follows, 2 inches, 1 inch and $\frac{1}{2}$, 1 inch and $\frac{1}{4}$; and all the centre pins tre-pins $\frac{1}{4}$ of an inch in diameter; the rope being $\frac{1}{10}$ of an inch in diameter.

The weight is 18 pounds *averdupois*; and consequently, the power to keep it in *æquilibrio* must be = 6 pound, and a very little more must make the power raise the weight, if there were no friction: But here no less than 20 ounces are required, tho' the machine be as nicely made, as it can possibly be.

Dr. *Desaguliers* has shewn by experiment, that when the weight is unknown, $\frac{2}{3}$ of the power is the friction of a cylinder, whose surface moves as fast as the power, and whose gudgeons are equal in diameter to the cylinder. Now as the diameter of the first pulley is 8 times bigger than its pin, its friction must be $\frac{4\,lb.}{8}$ or 8 ounces.

The 2d pulley, whose surface moves as slow again as the power, and whose pin is 6 times less in diameter, must consequently have its friction only 5 ounces and $\frac{1}{3}$; because

$$\frac{\frac{64\,oz.}{2}}{6} = 5\ oz.\ \text{and}\ \tfrac{1}{3}$$

The 3d pulley, moving with $\frac{1}{3}$ of the velocity of the power, on a pin of $\frac{1}{4}$ of its diameter, has for its friction $4\frac{1}{3}$ — *oz.* because $\frac{\frac{64\,oz.}{3}}{5} = 4\frac{1}{3}$ — *oz.*

Now the sum of all these frictions being 17,6 ounces, which is the 5,4 part of the power 6 *lb.* this addition does increase the friction in such manner, as to require a super-addition of the 5,4 part of that first addition; and so on in this series, ounces 17,62 + 3,2 + 0,59, *&c.* = 21,41 ounces.

Then the sum of the frictions, upon account of bending the ropes (too tedious to explain now, before he gives a full account in his intended theory of friction) deduced from the experiment, that a rope of $\frac{1}{10}$ inch in diameter stretch'd by 6 *lb.* requires 4,5 ounces to bend it round a cylinder of 1 inch ——, amounts to 1,8 + 1, 15 + 1, 124 = 4,424 ounces; which, with the other friction, amounts to 25,834 ounces. But as the Dr. has shewn in a former *Transaction*, that when a rope, drawn by unequal weight, runs over a pulley, the pressure on the pin is diminish'd; that diminish'd pressure (found by calculation to be near 6 ounces) being taken from the above sum, the

the friction remaining will be 19, 834 ounces; and the experiment is just 20 drachms.

N. B. Nothing was here allow'd for the weight added to bend the ropes, which would still bring the experiment nearer the theory.

A way to Communicate the magnetical Virtue to Iron *and* Steel, *without the help of a Loadstone, by M.* Arnold Marcel. Phil. Transf. N°. 423. p. 294.

IN 1722. M. *Marcel* observ'd that a long heavy bar of iron being set upright, and some filings of iron, or a bit of iron-wire, laid upon its upper end, those filings or bit of wire would stick to another piece of bright pointed iron, and suffer itself to be lifted up from the standing bar, even to the height of 5 inches.

In 1726, making several more observations about the magnetical force, which he found in large pieces of iron, he made use of a large iron vice, about 90 *lb.* weight, in which he fixed a small anvil of about 12 *lb.* Upon the bright surface of this anvil he laid the steel, to which he would communicate the virtue, in a position north and south, which happen'd to be in a diagonal of the square surface of the anvil: Then he took a piece of iron an inch square, and 33 inches long, of about 8 *lb.* weight, having at one end the figure (represented Fig. 7. Pl. VIII.) brightly polish'd at *a*, and taper at the other end: Then with one hand he held the piece of steel fast down upon the anvil, and with the other he held the iron-bar aforesaid perpendicular with it, with its point *a* upon the steel, and pressing hard, he rubbed the steel with the iron bar towards himself, from north to south, several strokes, always carrying the bar far enough round about to begin again at the north, to prevent the drawing back of the magnetical force: Having thus given 10 or 12 strokes, he turned the steel upside down, having it in the same position as to north and south; and after rubbing and turning it, till he rubbed it about 400 times, it receiv'd by degrees more and more strength, and at last had as much, as if it had been touch'd by a strong load-stone. The place where he began to rub was always that which pointed to the north, when the needle was hung, the end where he had ended the stroke turning to the south. Sometimes it has happen'd, that in a few strokes he gave the steel its virtue; nay even in the very first stroke one may give a great deal to a small needle. This way M.

Marcel

Marcel communicated the magnetical virtue to needles of sea-compasses, made of one piece of steel (as Fig. 8.) so strongly, that one of the poles would take up $\frac{3}{4}$, and the other a whole ounce of iron, tho' these needles were anointed with lintseed oil, which made a hard coat, to keep them from rusting; yet they retained the virtue: But in strenghthening this sort of needles, he rubbed by turns first to the right, and then to the left side.

The same way he brought the virtue into the point of a knife; so that it would sustain 1 ounce and $\frac{3}{4}$.

He brought the said virtue into 4 small pieces of steel, each 1 inch long, and $\frac{1}{12}$ inch broad, as thin as the spring of a watch. He joined these 4 pieces together, as into an artificial loadstone, weighing 18 grains *Troy*; and then it drew up and sustained an iron nail, which weigh'd 144 grains *Troy*: This artificial loadstone was for 6 years tumbled about, and lay among iron and steel, and in any position; and yet it rather acquired more than lost any of its virtue.

The magnetical virtue being thus communicated to iron or steel, he farther observ'd, that that end where the stroke was begun, would draw to the north, and where the stroke ended to the south, in whatever situation the steel had been laid upon the anvil to give it the virtue. He took a piece of steel, and rubbed it from one end to the middle; and then from the other end to the middle, and found it had 2 north poles, one at each end, and the middle a south pole.

Farther, beginning to rub from the middle towards each end of another piece of steel, he found it to have a south pole at each end, and a north pole in the middle.

He put a pretty heavy compass-needle, after he had given it its virtue into the fire, and made it red hot three times one after another, letting it grow cold every time: It lost some virtue every heat, but at the 3d heat it had a great deal still left, and making it for the 4th time white hot, it lost it all.

When he cover'd the anvil with a piece of woollen cloth, and the end of the iron bar with a piece of shamoy leather, it gave no virtue to the steel; then covering only the bar, and leaving the anvil uncover'd, it communicated no virtue that way neither: But covering the anvil, and leaving the bar uncover'd, it communicated the full virtue.

He tried, whether his vice had any fixed pole by standing long in one position, but he found it had none.

He tried to do this with an anvil of about 30 *lb* weight, fixed in wood; but could not come up to the other proofs.

He

He believes if one took an iron bar of 3 inches ſquare, and 10 or more feet long, or ſeveral of them upon each other, and a ſuitable piece or bar of iron to rub withal, and giving the underpart of the ſtanding bar the figure aforeſaid, repreſented by *b* (Fig. 11.) it might be brought to a vaſt ſtrength. N. B. the ſteel for the needles is always of a ſpring temper.

M. *Marcel* made 2 pieces of iron, at one end $\frac{3}{4}$ of an inch, and ſo taper to $\frac{1}{4}$ of an inch ſquare each (the length not being mentioned) and fixed thoſe 2 pieces of iron to a piece of wood in the ſhape of an armed loadſtone, at about 8 inches one from the other, applying to the under part of theſe irons, or legs, a piece of iron with a hook to it, as to an armed loadſtone: He hung this armed piece of wood with each leg over an iron bar (at a diſtance that ſomething might hang between them) then he placed the piece of iron with the hook to it to the 2 feet; and he found it to draw very ſtrongly; but his trial was but with ſmall tools. He ſuppoſes if one did this in a larger proportion, it would have a conſiderable effect.

Having ground ſome loadſtones with emmery, he ſaved the grindings, and mixing them with water; ſo that they might eaſily be mov'd, he put them into a bottle to ſink, placing a loadſtone on each ſide; one with its north, and the other with its ſouth pole towards the bottle; and he found after the matter was ſettled and dried, that it formed itſelf into a ſort of loadſtone, which had a moderate ſtrength, and 2 regular poles.

Fig. 7. Pl. VIII. repreſents the end of the iron bar, with which the virtue is rubbed into ſteel or iron.

Fig. 8. the needle of a ſea-compaſs.

Fig. 9. the figure of the point on one ſide.

Fig. 10. the figure on the point of the other ſide.

A (Fig. 11.) repreſents the needle of a compaſs; B B the end or edge of the bar, with which the needle is rubbed, beginning at C C, and proceeding to D D.

An uncommon Caſe of a diſtemper'd Skin; *by Mr.* John Machin. Phil. Tranſ. N° 424. p. 299.

A Country labourer, living not far from *Euſton-hall* in *Suffolk*, ſhewed a boy (his ſon) about 14 years of age, having a cuticular diſtemper, of a different kind from any hitherto mentioned in the hiſtories of diſeaſes.

His ſkin (if it might be ſo called) ſeemed rather like a duſky colour'd thick caſe, exactly fitting every part of his body, made of a rugged bark, or hide, with briſtles in ſome places; which

caſe,

cafe, covering the whole body excepting the face, the palms of the hands, and the ſoles of the feet, cauſed an appearance, as if thoſe alone were naked, and the reſt cloathed: It did not bleed when cut or ſcarified, being callous and inſenſible. It was ſaid, that he ſheds it once every year, about autumn, at which time it uſually grows to the thickneſs of 3 quarters of an inch, and then it is thruſt off by a new ſkin, which is coming up underneath.

It was not eaſy to think of any ſort of ſkin, or natural integument, that exactly reſembled it: Some compared it to the bark of a tree; others thought it looked like ſeal-ſkin; others like the hide of the elephant, or the ſkin about the legs of the rhinoceros; and ſome took it to reſemble a large wart, or number of warts uniting and overſpreading the whole body. The briſtly parts, which were chiefly about the belly and flanks, looked, and ruſtled like the briſtles, or quills of a hedge-hog, ſhorn off within an inch of the ſkin.

The boy's face was well featured, and of a good complexion, if not rather too ruddy; and the palms of his hands were not harder, or in worſe condition than is uſual with workmen or labourers. His ſize was proper for his age; his body and limbs ſtrait, and excepting this deformity, well ſhapen.

This rugged covering gave him no pain or uneaſineſs, only that ſometimes after hard work, it was apt to ſtart and cleave, and cauſe a bleeding. And notwithſtanding the unuſual diſpoſition of his humours to form ſo ſtrange an integument, his natural excretions were ſaid to be in the ordinary courſe and manner, without any thing remarkable attending them.

The father knew of no accident to account for this diſtemper'd habit; but ſaid, that his ſkin was clear at his birth, as in other children, and continued ſo for about 7 or 8 weeks; after which, without his being ſick, it began to turn yellow, as if he had had the jaundice; from which by degrees it changed black; and in a little time it afterwards thicken'd, and grew into that ſtate it appeared in: That he was in health from his birth, and had no ſickneſs at the ſeaſon he ſheds it. He farther ſaid, that his mother had received no fright (to his knowledge) when ſhe was with child; and that ſhe bore him ſeveral children, none of which ever had this, or any other unuſual diſtemper or deformity upon them.

Fig. 1. Plate IX. repreſents the back of the boy's hand.

Fig. 2. A portion of this extraordinary *epidermis*, which was probably a prolongation of the nervous *papillæ*, grown to about the ſize of common twine packthread; and theſe ſtanding as cloſe together, as the briſtles in a bruſh, ſeemed, like them, to be all ſhorn off even, and of the ſame length, *viz.* about $\frac{1}{4}$ an inch above the ſkin.

Fig. 3. repreſents ſome of theſe briſtles, or ſtumps, magnified; where it is viſible that ſome of them are flat at top, others concave; ſome pointed like a cone, and others very irregular.

Conjectures on the Nature of intermitting and reciprocating Springs; *by Mr.* Joſeph Atwell. Phil. Tranſ. N° 424. p. 301.

THE following conjectures on the ſubject of intermitting and reciprocating ſprings were ſuggeſted to Mr. *Atwell* by the phenomena of a particular fountain he had ſeen the winter before.

The ſpring is ſituated at one end of the town of *Brixam* near *Torbay* in *Devonſhire*, and known by the name of *Laywell*.

It is a long mile diſtant from the ſea, upon the north and north-eaſt ſide of a ridge of hills, lying between it and the ſea, and making a turn or angle near this ſpring. It is ſituated in the ſide of thoſe hills, near the bottom, and ſeems to have its courſe from the ſouth-weſt towards the north-eaſt. There is a conſtant running ſtream, which diſcharges itſelf near one corner into a baſon about 8 foot in length, and 4 foot and $\frac{1}{2}$ in breadth, the outlet of which is at the fartheſt end from the entrance of the ſtream, about 3 foot wide, and of a ſufficient height. This Mr. *Atwell* mentions, that a better judgment may be made of the perpendicular riſe of the water in the baſon, at the time of the flux, or increaſe of the ſtream. Upon the outſide of the baſon are 3 other ſprings, which always run but with ſtreams ſubject to a like regular increaſe and decreaſe with the former. It is true, they ſeem to be only branches of the former, or rather channels diſcharging ſome parts of the conſtantly running water, which could not empty itſelf all into the baſon; and therefore when by means of the ſeaſon, or weather, ſprings are large and high, upon the flux or increaſe of this fountain, ſeveral other little ſprings are ſaid to break forth both in the bottom of the baſon, and without it; which diſappear again upon the ebb or decreaſe of the fountain. All the con-

conſtantly running ſtreams put together, at the time Mr. *Atwell* ſaw them, were, he thinks, more than ſufficient to drive an over-ſhot mill; and the ſtream running into the baſon might be about one half of the whole.

Mr. *Atwell* made a journey on purpoſe to ſee it, in company with a friend. When they came to the fountain, they were informed by a man, working juſt by the baſon, that the ſpring had flowed and ebbed about 20 times that morning; but had ceaſed doing ſo, about half an hour before they came. Mr. *Atwell* obſerved the ſtream running into the baſon, for more than an hour by his watch, without perceiving the leaſt variation in it, or the leaſt alteration in the height of the ſurface of the water in the baſon; which they could obſerve very nicely, by means of a broad ſtone laid in a ſhelving poſition in the water. Thus diſappointed they were obliged to go and take ſome little refreſhment at an inn; after which they intended to come back and ſpend the reſt of their time before they returned home. They were told in the town of *Brixam*, that ſeveral had been diſappointed in this manner; and the common people ſuperſtitiouſly imputed it to ſome influence, they ſuppoſe the preſence of ſome people to have over the fountain.

Upon their return to it, the man, who was ſtill at work, told them it began to ebb and flow about half an hour after they were gone, and had done ſo for 10 or 12 times. In leſs than a minute they ſaw the ſtream coming into the baſon, and likewiſe the others on the outſide of the baſon, begin to increaſe and to flow with great violence; upon which the ſurface of the water in the baſon roſe an inch and a quarter perpendicularly, in near the ſpace of 2 minutes: Immediately after which, the ſtream began to abate again to its ordinary courſe; and in near 2 minutes time the ſurface was ſunk down to its uſual height, at which it remained near 2 minutes more. Then it began to flow again as before; and in the ſpace of 26 minutes it flowed and ebbed 5 times: So that an increaſe, decreaſe, and pauſe, taken together, were made in about 5 minutes, or a little more.

Mr. *Atwell* could obſerve by the mark upon the ſtones, that the ſurface of the water in the baſon had riſen before they were come, at leaſt 3 quarters of an inch perpendicularly higher than when they ſaw it; and he thought that he could perceive ſome very little abatement each turn, both in the height, and in the time of the riſing of the ſurface; and conſequently in the time of its ſinking: But the time of the pauſe, or ſtanding of the ſurface at its uſual height, or equable running of the ſtream,

 was

was lengthen'd; yet so as to leave some abatement in the time of the rising, sinking, and pause, taken together. This is all Mr. *Atwell*'s short time would allow him to observe; several other things should have been taken notice of, as will appear from the hypothesis proposed to explain these phenomena.

But before Mr. *Atwell* enters upon explaining that hypothesis, he remarks what difference or agreement is to be found between this account of the fountain, and another published in *Phil. Trans.* N° 204. p. 909, 910, in 2 letters from Dr. *Oliver*. The Dr. places it a mile and a half from *Brixam*; Mr. *Atwell* supposes he means *Brixam quay*, which is more than a mile off from the town. He gives the dimensions of the bason a little different from Mr. *Atwell*, making its surface 30 foot square; whereas Mr. *Atwell* makes it 36. The Dr. says, that it ebbs and flows often every hour; which is certainly false, as appears both by common report, and by Mr. *Atwell*'s observation: It is true, when it once begins to flow and ebb, it continues to do so for several times in an hour; but then there is after this again a certain space of time, perhaps, 2 hours or more, when it runs with an equable stream, without any the least variation; and this is a particular circumstance not observed in any spring whatsoever. When the Dr. first saw it, *viz.* in *July* 1693, he says that he judged the flux and reflux, as he calls them, to be performed in about 2 minutes: If he mean 2 minutes each, it agrees very well with Mr. *Atwell*'s observations; but as the former had neither glass nor minute-watch with him, this observation cannot be depended on. When the Dr. saw it again, *viz.* in *August* the same year, he judged it to flow slower than before; which he explains by saying, that tho' it performed its flux and reflux in little more than a minute (which by the bye is quicker than before) yet it would stand at the low-water mark 2 or 3 minutes; which Mr. *Atwell* supposes the Dr. calls flowing slower than before; because the space of time between the end of the ebb and the beginning of the succeeding flux was longer. If we suppose the Dr. to have made his observations somewhat nearer the time, when the fountain was to cease ebbing and flowing, than Mr. *Atwell* made his, their observations will perhaps exactly agree: The time of the flux and reflux being shorter, the time of the pause longer; but the whole time of the flux, reflux, and pause, taken together, being shorter by the Dr's account than by Mr. *Atwell*'s. The former says, that he found it by his watch to flow and ebb 16 times in an hour. The latter does not suppose that the Dr. made a

whole

whole hour's obſervations, which muſt have ſhewn him a difference in the times of the reciprocations that he did not perceive: But having obſerved that one reciprocation, or a flux, reflux, and pauſe, took up about the ſpace of 4 minutes, the Dr. thence computed, as Mr. *Atwell* imagines, that there would be 16 in an hour, preſuming that there was no alteration in the times. In this ſenſe Mr. *Atwell* would underſtand the Dr. when he adds, that he was informed, it ſometimes flow'd 20 times in an hour: For, according to the Dr's obſervation, it flow'd at the rate of 16 times in an hour; according to Mr. *Atwell*'s obſervations, at the rate of 12 times in an hour; probably, before the latter's obſervations at a leſs rate, and after the former's at a greater: So that in the whole hour, according to the ſeveral rates taken together, it may flow and ebb about 9 or 10 times, according to another account Mr. *Atwell* received; but of this he can aſſert nothing certain, or upon his own obſervations. The Dr. adds that when the water in the baſon began to riſe, he obſerved a bubbling in the bottom of the baſon, which ceaſed when the water began to ſink. This Mr. *Atwell* did not ſee, becauſe the ſprings were ſmall and low, by means of a dry ſeaſon; but it was confirmed to him by the report of eye-witneſſes, as is before obſerved.

Having thus compared the 2 accounts given of this fountain, Mr. *Atwell* comes now to his hypotheſis for explaining the phenomena obſerved by him; and he imagines them to be occaſioned by 2 ſtreams, or ſprings; one of which paſſing thro' 2 caverns or natural reſervoirs with ſiphons, meets with the other ſtream in a third reſervoir without a ſiphon; where being joined, they come out of the earth together. This complicated piece of machinery will be beſt underſtood by beginning with an explanation of the more ſimple parts firſt; in doing of which, an opportunity will offer of conſidering ſome other ſorts of fountains, which have already been obſerved, or may hereafter be found to be in nature.

The *petitio principii*, or ſuppoſition of reſervoirs and ſiphons in the bowels of the earth has been made by others: F. *Regnault* in his *Phil. Converſat. Vol.* 2. *Conv.* 6. p. 125, &c. *Eng. Edit.* has mentioned it in general; and Dr. *Deſaguliers* in *Phil. Tranſ.* N° 384. has attempted to apply it to 2 caſes in particular; as *Deſchales Tract.* 17. *de fontibus natural.* &c. *Prop.* 15. had done in 2 other caſes before him. Nor is it unnatural or hard to be granted. For, whoever has ſeen the *Peak* of *Derbyſhire*, the hilly parts of *Wales*, or other countries,

muſt

muſt be ſatisfied that they abound with caverns of ſeveral ſorts: Some of them dry, others ſerving only for paſſages, or channels to ſtreams, which run thro' them; and a 3d ſort collecting and holding water, till they are full. They muſt likewiſe have obſerv'd, that there are ſometimes narrow paſſages running between the rocks, which compoſe the ſides and go from one cavern to another: Such a paſſage, of whatever ſhape or dimenſions, how crooked and winding ſoever in its courſe, if it be but tight, and run from the lower part of the cavern, firſt upwards to a leſs height than that of the cavern, and then downwards below the mouth of the ſaid paſſage, it will be a natural ſiphon.

A natural reſervoir then, A B C D, (Fig. 4. Pl. IX.) with ſuch a natural ſiphon, M N P, may be ſuppoſed. Let a ſtream, which Mr. *Atwell* calls the feeding ſtream, enter it, near the top at O; the ſaid cavern muſt contain all the water, which comes in at O, till it be filled to the top of the ſyphon at N: Then the ſiphon beginning to play, and being ſuppoſed always to diſcharge more water than comes in by the feeding ſtream at O, will empty the cavern, till the water be ſunk in it below the mouth of the ſiphon at M, when it muſt ſtop, till the cavern be filled, and the ſiphon run again as before: If the water diſcharged by ſuch a ſiphon, M P, be brought out of the earth by a channel P Q, the water will flow out of the earth, and ſtop alternately, making an intermitting fountain at Q.

By this plain and eaſy contrivance, ſeveral of the flowing and ebbing ſprings, obſerv'd by naturaliſts, may probably be explained; and even a much greater variety of them than is hitherto known: For, if the feeding ſtream at O ſhould ariſe only from the rains in winter, or from the melting of the ſnow in ſummer, the intermitting fountain would become a temporary ſpring, as Dr. *Plot* calls ſuch ſprings as are confined to a ſeaſon: Or if the feeding ſtream at O ſhould be conſtant, but yet liable with other ſprings to an increaſe and decreaſe ariſing from the ſeaſons, weather, or other cauſes, the conſtruction of the ſiphon would make a great alteration: For, when the ſiphon is made in ſuch manner that its diſcharge (which is continually decreaſing, as the ſurface of the water ſubſides in the cavern) ſhall at any time be equal to the feeding ſtream entering at O; in ſuch a caſe the ſiphon muſt continually run, and yet not empty the cavern till the feeding ſtream at O be ſufficiently diminiſh'd: But when the diameter of the ſiphon at N, according to the height of the cavern, is ſo great; and the feeding ſtream at O ſo ſmall, that the ſiphon can carry off (in the manner of a waſte-pipe) all the water which comes in, and yet not run with a full ſtream; the ſiphon muſt then continue to run without emptying the cavern, till the feeding ſtream at O be ſufficiently enlarged: So that by theſe different conſtructions of the ſiphon, there may be ſome fountains, which ſhall flow conſtantly in the winter, or a wet ſeaſon, and intermit in the ſummer, or in a dry ſeaſon: And on the contrary, others, which ſhall flow continually in the ſummer, or a dry ſeaſon, and intermit in the winter, or a wet ſeaſon. There is a 3d variety, which may ariſe from the make of the ſiphon, and will occaſion ſuch irregularities, as admit of no certain explanation. This happens when the diſcharge of the ſiphon at the very laſt is juſt equal to the feeding ſtream, and the cavity of the ſiphon at N is large: For, in this caſe, the air-bubbles, made by the fall of the feeding ſtream from O to the bottom of the cavern, will ſometimes accidentally get into the mouth of the ſiphon at M, and lodging at N, will ſo choak it, as to render its running and ſtopping, as well as the quantity of its diſcharge, entirely uncertain: So that this ſort of fountains will admit of no farther conſideration.

But before Mr. *Atwell* leaves the conſideration of fountains explicable by one reſervoir and ſiphon; he thinks it may not be amiſs to obſerve, that thoſe, which intermit regularly, will have their flux always longer, and their pauſe, or intermiſſion, ſhorter in winter and in wet weather, than in ſummer or in a dry ſeaſon; which is a conſequence of this hypotheſis, by which it may be examined, whether it be applicable to any particular intermitting fountain, or no.

If the ſingle reſervoir and ſiphon have another out-let as R, (Fig. 5.) ſituated between the bottom C D of the cavern, and the top of the ſiphon N, we ſhall have another kind of fountains. For, if the feeding ſtream at O be capable of being diſcharged by the out-let at R, a fountain deriv'd from R will continually run, whilſt the feeding ſtream can be diſcharged that way; and will increaſe and decreaſe with any little alteration happening to the feeding ſtream at O; provided that the ſaid ſtream do not grow too large for the out-let at R. But in that caſe the cavern muſt be filled up to N, and the ſiphon may begin to play; which, together with the out-let at R, may diſcharge ſo much as to make the ſurface of the water in the cavern ſink below R; and conſequently, the fountain proceeding

ceeding from R muſt ſtop. If the diſcharge of the ſiphon be ſo conſiderable as to empty the cavern, then the fountain deriv'd from R will, after ſome time, begin to run again, and increaſe till the water riſe in the cavern to N; after which it will decreaſe, and at length ſtop. But if the diſcharge of the ſiphon only keep the ſurface of the water below R, without emptying the cavern; then the fountain deriv'd from R ſhall be dried up, ſo long as the ſtream at O continues increaſed; and ſhall run again when the ſaid feeding ſtream is leſſen'd. Thus we may have a ſpring which ſhall run all ſummer, and be dry all winter: Such a ſpring will increaſe juſt before it begins to fail, *i. e.* whilſt the water in the cavern is riſing to N; will be dried up ſooner in a wet ſummer, and break out later in a wet winter, contrary to the nature of other ſprings. Which particulars are worthy of obſervation in ſuch ſort of ſprings (of which it is ſaid we have ſome in *England*) and will ſerve to diſcover, whether they are occaſioned by this ſort of machinery, or not.

If the ſiphon M N P (Fig. 6.) of the reſervoir A B C D, having no out-let at R, ſhould diſcharge itſelf into a ſecond reſervoir E F G H of a ſmaller capacity, but furniſh'd with a ſiphon S T V, which diſcharges the water more plentifully than it comes in; a fountain, deriv'd from this ſecond ſiphon, S T V, would flow and intermit; whilſt the firſt ſiphon M N P, continued running, *i. e.* till the great reſervoir A B C D ſhould be emptied. After which it would entirely ſtop, till the ſaid reſervoir A B C D was filled again by the feeding ſtream at O; and then it would flow and intermit as before.

Such a ſort of compound fountain would be liable to all the variations of the former fountains, deriv'd from a ſingle reſervoir; if we take the fits of flowing and intermitting of this for the flux of the former; and the long ſtop in this, whilſt the great reſervoir is filling, for the pauſe or intermiſſion of the former. Beſides which, we muſt remark, that as the flux in the former fountains may be changed, and be made longer or ſhorter; ſo in this the number of intermiſſions, during one fit of flowing and intermitting, may not always be the ſame; becauſe of the different capacities of the 2 reſervoirs; and a difference or change occaſioned in the feeding ſtream at O. For, if whilſt the great reſervoir A B C D is emptying, the little reſervoir E F G H ſhould empty itſelf 9 times, for inſtance, and be half-full again, the fountain deriv'd from its ſiphon S T V muſt have 9 intermiſſions in one fit, and 10 in another alter-

alternately; whilst the feeding stream at O remains the same. But the feeding stream at O being lessen'd, or enlarged, without making the siphon MNP run continually, the number of intermissions in each fit will be diminish'd or augmented accordingly. But it is peculiar to this last sort of fountains, that in each fit of flowing, and intermitting, the first flux will be larger and longer than the 2d; and the 2d than the 3d; but the first intermission will be shorter than the 2d; and the 2d than the 3d; because the siphon MNP running faster at first than at last, the reservoir EFGH must be a shorter time in being filled, and a longer time in being emptied the first time than the 2d; the 2d than the third, and so on. As to the whole time of the first flux and intermission, in comparison of the whole time of the 2d flux and intermission, it is a particular requiring so many things to be taken into consideration for determining it in each case, that Mr. *Atwell* waves it here, and contents himself with shewing that it may be longer by an experiment that shall presently be made. Another variety in this sort of fountains might be made by a 2d feeding stream Z, coming into the 2d reservoir EFGH, but the bare mentioning of that will at present be sufficient.

If in the contrivance of a single reservoir, and siphon, the stream deriv'd from the siphon should fall into another reservoir IKKL (Fig. 7.) having no siphon, but only a common out-let X, and should in this reservoir meet and join with another stream, constantly running, a fountain deriv'd from the said out-let X would be a reciprocating spring, by which name Mr. *Atwell* calls those springs which flow constantly, but with a stream subject to increase and decrease, to distinguish them from intermitting springs, which flow and stop alternately. And if the out-let X be too small to carry off all the water brought into the reservoir IKKL by the siphon, over and above what is brought in by the constant running stream W; then the surface of the water in the said reservoir IKKL must continually rise, till the velocity of the stream, going out at X, be sufficiently increas'd to carry off the water coming in: Upon which the discharge of the siphon being continually lessen'd, the said surface will again subside, and the velocity of the stream at X will diminish: So that both the increase and decrease in this reciprocating fountain will be gradual. Besides, if the reservoir IKKL, or the channel, deriv'd from it, should have any leaks, crevices or other out-lets, the water will issue thro' them upon the rising of the ſurface in the ſaid reſervoir, and occaſion ſprings, which will ceaſe again when the ſurface ſubſides.

Let us now ſuppoſe ſuch a reſervoir IKKL (Fig. 8.) with a conſtant running ſtream W, and an out-let X, to receive the water of a ſiphon STV, coming thro' two reſervoirs ABCD and EFGH, as before deſcribed: A fountain deriv'd from X in this caſe, would be an intermitting reciprocating ſpring, whoſe ſtream would reciprocate; but whoſe reciprocations would ſometimes ſtop, and have fits of intermiſſion.

Such, in all probability, is the fountain call'd *Laywell*, before deſcribed, whoſe phenomena ſeem capable of being accounted for by ſuch a contrivance. And for the better diſcovery of the nature of this fountain, whether it be owing to ſuch a piece of natural machinery, or otherwiſe, it would be proper to obſerve the length of time of each increaſe, decreaſe, and pauſe in every reciprocation, together with the number of reciprocations in every reciprocating fit; and likewiſe the length of the intermiſſions of the ſaid fits. Theſe obſervations ſhould be continued for ſome time, both in a ſettled ſeaſon, when the feeding ſtream at O cannot change, and in variety of ſeaſons, when the ſaid ſtream may be alter'd.

Mr. *Atwell* concludes, by preſenting to view an artificial fountain of this kind, which, being very eaſily made, may be buried in the bottom or ſlope of a terraſs, where a conſtant ſtream of water can be brought; which will furniſh us with a new ſort of water-works in gardens. The two reſervoirs ABCD, EFGH (Fig. 8.) with their ſiphons MNP, STV, and the third reſervoir IKKL, with its out-let X, are included in a box YYYY; into this box at λ enters a funnel Γλ Γ, divided within the box into two pipes, *viz.* λ O, which ſerves for a feeding ſtream to the great reſervoir and λ W, which ſerves for a conſtant ſtream to the third reſervoir. A ſtream of water, being let into the funnel Γλ Γ, will diſcharge itſelf like ſuch an intermitting reciprocating fountain at X, where there is a baſon YZZZ without the box to receive it, with an out-let α, and a diagonal gage ZY, to mark the riſe and fall of the water in the baſon.

Ecliſſes

Eclipses of Jupiter's *Satellites observ'd at* Pekin *in* 1730, 1731; *by F.* Koegler *and* Pereira. Phil. Transf. N° 424. p. 316.

Satellite I.

Immersions.

	D.	H.	M.	S.	
Nov. 1730	3	18	0	0	*p. m.*
	12	14	20	0	
	19	16	12	0	
Dec.	26	18	3	0	
	5	14	22	54	
	12	16	11	30	
	19	18	0	45	
	21	12	28	40	
	28	14	18	10	
Jan 1731	4	16	8	45	
	6	10	35	20	
	11	17	59	30	
	13	12	27	10	
	20	14	17	30	
	27	16	10	12	
Feb.	3	18	2	36	
	12	14	25	0	dubious
	14	8	54	20	
March	2	9	30	0	

Emersions.

	D.	H.	M.	S.
	9	11	27	40
	16	13	23	30
	18	7	52	40
April	1	11	45	20
	3	6	15	0
	17	10	8	40
	24	12	4	30
May	3	8	29	50

Satellite II.

Immersions.

	D.	H.	M.	S.	
Nov. 1730	25	16	5	30	
Dec.	2	18	37	0;	dubious

Dec.

	D.	H.	M.	S.
Dec. 1730.	20	12	49	45
	27	15	21	5
Jan. 1731.	3	17	49	50
	14	9	30	45
	28	14	37	30
Feb.	4	17	10	
	15	8	59	

Emersions.

Mar. 1731	19	11	29	20
Apr.	13	8	35	
	20	11	16	

Satellite III.

Immersion *Nov.* 1730	21	16	16	30
Emersion *Dec.*	20	11	27	50
Immersion	27	11	49	30
Emersion		15	21	17
Immersion *Jan.* 1731.	3	15	43	15
Emersion			19	16; dubious
Immersion *Feb.*	8	11	25	30
Immersion	15	15	23	
Emersion *March*	9	6	50	30
Emersion	16	10	50	50
Emersion	23	14	51	30
Emersion *April*	21	6	56	20
Immersion	28	7	28	30
Emersion		10	55	30
Immersion *May*	5	11	30	30

Satellite IV.

Immersion *Dec.* 1730.	20	18	50	45
Immersion *Jan.* 1731.	6	12	38	12
Emersion		17	6	45
Emersion	23	10	54	
Immersion *March*	31	6	between 30′ and 35″	
Emersion		10	43	40

An Occultation of Mars *by the* Moon, *together with Occultations of the* Pleiades, *and some other fixed Stars, observ'd at* Pekin *in* 1731. Phil. Transf. N° 424. p. 318. *Translated from the* Latin.

NOV. 14, 1731, about 4^h *p. m.* the moon covered *Mars*: The immersion could not be observ'd, by reason of the brightness of the day; yet the emersion was observ'd at 4^h 54′ near *Furnerius*.

Jan. 17, 1731, a transit of the moon over the *pleiades* was observ'd as follows.

p. m. H.	M.	S.	
10	9	40	*Electra* immerged in a right line passing thro' *Plato* and *Eudoxus*.
10	32	50	*Merope* immerged in a right line thro' *Copernicus* and *Messala*.
10	38	15	*Electra* emerged in a right line thro' *Thaletes* and *Eudoxus*.
11	23	52	The preceeding *Lucida Pleiadum* (a triple small star) immerged in a right line thro' *Eratosthenes* and S. *Cyrillus*.
11	26	5	*Lucida Pleiadum* or *Alcyone* immerged in a right line thro' *Copernicus* and S. *Catharina*.
11	47	32	*Merope* emerged in a right line thro' *Taruntius* and S. *Theophilus*.
12	1	10	The brighter of the small stars to the south of *Atlas* immerged in a right line thro' *Bullialdus* and *Censorinus*.
12	12	12	*Atlas* immerged in a right line thro' *Copernicus* and *Julius Cæsar*.
12	13	57	*Alcyone* emerged in a right line passing thro' the eastern edge of *Possidonius* and *Menelaus*.
12	25	3	*Pleione* immerged in a right line thro' *Copernicus* and *Ptolomæus*.

March 14, 1731. the moon hid κ of *Taurus*; the immersion was at 8^h 41′ 50″ *p. m.* in a right line passing thro' *Taruntius* and *Langrenus*; and the emersion at 9^h 51′ a little to the south of *Firmicus*.

March 20. the moon hid π of *Leo*: The immersion was at 11^h 13′ *p. m.* in a right line passing thro' *Mersennus* and *Bullialdus*; and the emersion at 12^h 31′ over against *Firmicus*.

April

April 16, the moon hid *o* of *Leo:* The immersion was at $8^h\ 46'\ 30''$ *p. m.* in a right line passing thro' *Bullialdus* and *Censorinus*; the emersion at $10^h\ 5'\ 45''$ in a right line passing thro' *Taruntius* and *Menelaus.*

A Lunar Eclipse observ'd at Chamxo *in the Province of* Nankin, *as also at* Cochinchina July 29, 1730, *N. S. by F.* Simonelli *and* De Lima. Phil. Transf. N° 424. p. 320. *Translated from the* Latin.

THIS eclipse could not be observ'd at *Pekin* by reason of a thick fog; yet F. *Simonelli* observ'd it at *Chamxo*, a town in the province of *Nankin*, a little more than 4° of the equator to the east of *Pekin*, *i. e.* 16 or 17 minutes of time.

Phases	Time *p. m.* H.	′	″
The beginning of the eclipse at	10	55	0
The end	12	49	0
The greatest obscuration 3 *Chinese* dig. and 10′			
Therefore the middle of the eclipse at *Chamxo* was at	11	52	0
At *Pekin* by calculation	11	36	0
The difference pretty exact	0	16	0

F. *De Lima* observ'd the same eclipse at the palace of *Cochinchina.*

Phases	Time H.	′	″
The begining of the eclipse at	9	48	0
The end	11	50	0
Consequently the middle was at	10	54	0
The middle of the eclipse at *Pekin* by calcul.	11	36	0
Whence arises the difference of meridians of *Cochinchina* and *Pekin* 42′ of time to the west, *i. e.* 10° 30′ of the equator.	0	42	0

Expe-

Experiments to prove the Existence of a Fluid in the Nerves, *together with Inferences from these Experiments; by Dr.* Alexander Stuart. Phil. Transf. N° 424. p. 324.

EXperiment 1. Dr. *Stuart* suspended a frog by the fore-legs in a frame, leaving the inferior parts loose; then the head being cut off with a pair of sciffars, he made a slight push perpendicularly downwards, upon the uppermost extremity of the spinal marrow in the upper *vertebra*, with the button end of the probe, filed flat and smooth for that purpose; whereby all the inferior parts were instantaneously brought into the fullest and strongest contraction; and this he repeated several times on the same frog, with equal success, intermitting a few seconds of time between the pushes, which if repeated too quick, made the contractions much slighter.

Exp. 2. With the same flat button end of the probe he push'd slightly towards the brain in the head, upon that part of the *medulla oblongata*, appearing in the occipital hole of the scull; upon which the eyes were convulsed. This he likewise repeated several times on the same head, with the same effect.

Exp. 3. He tied a piece of fine twine, or thread, parallel to the crural artery, vein and nerve of a dog; and he made a ligature on these, and on the parallel twine, above and below, at the distance of about four inches; then he cut beyond the ligatures above and below, so as to take out the vessels and nerve, together with the parallel twine, in one bundle; and laying them on a board, both the artery and vein contracted immediately, and were shortened to almost one half of the natural length they had in the body; to wit, to two inches and a half: Whereas the nerve remain'd uncontracted, at its natural length, and commensurate to the parallel twine of four inches, as before it was cut out of the body, according to

Fig. 9. Plate IX. which represents the nerve and twine at their natural length; namely, four inches: And

Fig. 10. which represents the artery and vein contracted; 2 inches and $\frac{1}{2}$.

By which it appears that the proportion of the blood-vessels in their compleatest contraction, to themselves in a state of extension, and to the nerves at their constant and natural length, is nearly as 5 to 8, or which is the same thing, any given section of a blood-vessel, cut out and left to itself, is

capable

capable of contracting, so as to lose $\frac{3}{8}$ parts of its length. But tho' this experiment may suffice for estimating the elasticity of the blood-vessels in general; yet it is not to be doubted, but the degree of their strength and elasticity may differ a little more or less in animals of different species, and individuals of the same species; nay even in the same individual at different stages of life: But these differences are not material to the present purpose, which is only to shew, that the nerves are not elastic; and that the blood-vessels are so to a very considerable degree.

The two first experiments shew, that the brain and nerves contribute to muscular motion, and that to a very high degree: The third experiment makes it as plain, that what they contribute to muscular motion cannot arise from, or be owing to elasticity, which they have not. What remains, therefore, but to conclude, that the action of the nerves in muscular motion is owing to the fluid they contain, by whatever name we may chuse to call it.

To fortify this conclusion, let us consider that we can have no other evidence of the existence of that invisible fluid the air, and of its several qualities of elasticity and gravity, but what arises from experiments and observations of its effects, which are sufficiently satisfactory; and convince us of its existence, tho' the minute particles of its composition fall under none of our senses. Therefore, in the same manner, seeing these experiments put the elasticity and elastic vibrations of the nerves quite out of the question, the Dr. thinks we may as fairly conclude, that there is a fluid in the nerves, tho' invisible; as that there is such a fluid call'd the air, tho' it cannot be seen.

The Dr. only adds, that tho' we may call this nervous fluid by any name, to which a proper, determined and fix'd idea is annex'd; yet he thinks the word *(spirits)* was an unhappy choice, as it includes an idea either of something like the spirits of fermented liquors, or some of the saline volatile spirits, as that of hartshorn, *&c.* or a flying vapour or exhalation: All which being loose and indetermined, have serv'd only to mislead the inquisitive, and amuse the ignorant. But the source from which this fluid ariseth, to wit, the circulating blood; the vessels thro' which it is secreted; the nerves in which it moves and is contained; the soft and almost insipid taste, and no smell observable in the brain and nerves, suggest no idea of such spirits: And the simple qualities of a pure and perfectly defecated elementary water will better suit

suit all that our senses can discover of it; and are indeed sufficient to solve all the phenomena of the animal œconomy, as far as they depend upon the nerves.

Observations of Latitude *and* Variation, *taken on Board the* Hartford, *in her Passage from* Java-head *to St.* Helena *in* 1731-2; *by Dr.* Halley. Phil. Transf. N° 424. p. 331.

ON *Wednesday, Feb.* 2. we took our departure from *Java-head*, allowing it to lie in the Lat. of 6° 45′ south.

	°	′	
By a good amplitude made	3	28	Variat. NWly. *Feb.* 7.
Latitude by account	9	59	South.
Merid. dist. from *Java Head*		43	West.
Longitude from ditto		45	
By a good azimuth made	4	45	Variat. NWly. *Feb.* 13.
Latitude by good observation	13	43	South.
Merid. dist. from *Java Head*	3	31	West.
Longitude from ditto	3	36	
By a good amplitude	4	52	Variat. NWly. *Feb.* 15.
Latitude *per* observation	15	18	South.
Merid. dist. from *Java Head*	6	1	West.
Longitude from ditto	6	9	
By a good azimuth and amplitude	4	51	Variat. NWly. *Feb.* 21.
Latitude *per* observation	18	12	South.
Merid. dist. from *Java Head*	17	28	West.
Longitude from ditto	18	00	
By good amplitude	6	8	Variat. NWly. *Feb.* 25.
Latitude *per* observation	19	59	South.
Merid. dist. from *Java Head*	21	17	West.
Longitude from ditto	32	1	
By a good azimuth	10	3	Variat. NWly. *Feb.* 29.
Latitude *per* observation	21	00	South.
Merid. dist. from *Java Head*	30	28	West.
Longitude from ditto	32	12	
By a good amplitude made	15	15	Variat. NWly. *March* 5.
Latitude *per* observation	23	16	South.
Merid. dist. from *Java Head*	37	18	West.
Longitude from ditto	38	58	
By a good amplitude made	18	2	Variat. NWly. *March* 8.
Latitude *per* observation	25	11	South.
Merid. dist. from *Java Head*	40	30	West.
Longitude from ditto	42	33	
By an azimuth and amplit. made	19	00	Variat. NWly. *Mar.* 10.
Latitude *per* observation	26	18	South.
Meridian distance	42	42	West.
Longitude	44	15	

		°	′	
March 13.	By a very good amplitude	21	45	Variat. NW
	Latitude *per* obſervation	27	23	South.
	Meridian diſtance	44	14	West.
	Longitude from *Java*	46	34	
Mar. 17.	By a good azimuth made	24	23	Variat. NW
	Latitude by account	30	25	South.
	Merid. diſt. from *Java Head*	52	29	West.
	Longitude ditto	54	51	
Mar. 19.	By a good azimuth had	24	50	Variat. NW
	Latitude *per* obſervation	30	27	South.
	Meridian diſtance	56	40	West.
	Longitude	59	21	
Mar. 22.	By a good azimuth had	24	15	Variat. NW
	Latitude *per* account	31	23	South.
	Meridian diſtance from *Java Head*	61	37	West.
	Longitude from ditto	66	3	
Mar. 24.	By a good amplitude had	23	51	Variat. NW
	Latitude *per* obſervation	32	47	South.
	Meridian diſtance	63	00	West.
	Longitude	67	44	
April 1.	By a good amplitude made	20	16	Variat. NW
	Latitude by obſervation	34	58	South.
	Meridian diſtance from *Java Head*	73	36	West.
	Longitude from ditto	79	44	
Apr. 4.	By a good azimuth and amplitude	20	07	Variat. NW
	Latitude *per* obſervation	35	33	South.
	Meridian diſtance from *Java Head*	74	42	West.
	Longitude from ditto	81	24	
Apr. 6.	By a good amplitude made	19	7	Variat. NW
	Latitude by obſervation	35	41	South.
	Meridian diſtance from *Java Head*	77	2	West.
	Longitude from ditto	87	12	
Apr. 7.	By a very amplit. made	17	30	Variat. NW
	Latitude *per* obſervation	36	25	South.
	Meridian Diſtance from *Java Head*	77	56	West.
	Longitude from ditto	87	58	
Apr. 10.	By a good azim. and amplit. made	16	9	Variat. NW
	Latitude *per* obſervation	38	10	South.
	Meridian diſtance from *Java Head*	77	24	West.
	Longitude from ditto	87	26	
Apr. 13.	By a very azim. and ampl.	15	40	Variat. NW
	Latitude *per* obſervation	37	58	South.
	Meridian diſtance from *Java Head*	77	21	West.
	Longitude from ditto	85	15	
Apr. 14.	By a very good azim. and ampl.	15	45	Variat. NW
	Latitude *per* obſervation	37	4	South.

Merid

	°	′	
Meridian diſtance from *Java Head*	76	54	Weſt.
Longitude from ditto	84	42	

N. B. This day he judged Cape *Bonne Eſperance* to bear N. by W. from him, diſtance 2° 54′.

	°	′		
By a very good azimuth made	16	14	Variat. NWly.	*April* 16.
Latitude *per* obſervation	36	15	South.	
Meridian diſtance from *Java Head*	77	59		
Ditto from Cape *Bonne Eſperance*	00	30	Weſt.	
Longitude from *Java Head*	85	14		
By a very good amplitude made	15	45	Variat. NWly.	*Apr.* 18.
Latitude *per* obſervation	35	33	South.	
Meridian diſtance from *Java Head*	79	5		
Ditto from Cape *Bonne Eſperance*	1	36	Weſt.	
Longitude from *Java Head*	86	10		
By a very good azimuth made	14	40	Variat. NWly.	*Apr.* 21.
Latitude *per* obſervation	32	23	South.	
Meridian diſtance from *Java Head*	81	9		
Ditto from Cape *Bonne Eſperance*	3	40	Weſt.	
Longitude from *Java Head*	87	9		
By a good amplitude made	12	39	Variat. NWly.	*Apr.* 24.
Latitude by obſervation	27	1	South.	
Meridian diſtance from *Java Head*	84	52		
Ditto from Cape *Bonne Eſperance*	7	23	Weſt.	
Longitude from *Java Head*	89	18		
By a good azimuth made	11	20	Variation.	*Apr.* 29.
Latitude *per* obſervation	21	45	South.	
Meridian diſtance from *Java Head*	89	8		
Ditto from Cape *Bonne Eſperance*	11	41	Weſt.	
Longitude from *Java Head*	92	20		
Latitude *per* obſervation	16	00	South.	*May* 5.
Meridian diſtance from *Java Head*	97	43		
Ditto from Cape *Bonne Eſperance*	20	16	Weſt.	
Longitude from *Java Head*	99	53		
By an ampl the night before came in	8	00	NWly.	

At noon Barn. bore W. b. N. half N. diſtance 4 miles.

An Eruption *of* Mount Veſuvius, *extracted from the meteorological Diary at* Naples; *by Dr.* Cyrillus. Phil. Tranſ. N° 424. p. 336.

THE thermometer made uſe of in this diary was made by Mr. *Hauksbee*, in which the freezing point is marked at 65 degrees under the point extreme hot: But the Dr. obſerves

 that

that at *Naples* water will freeze, when this thermometer ſtands at 55 degrees only: Which, according to him, ſeems to argue that there is ſomething elſe beſides an intenſe degree of cold required for freezing water; that the air of *Naples* abounds in it more than that of *London*; and that this may, probably, be of a ſaline nature; becauſe when we turn water into ice by the help of ſnow, it is neceſſary to mix ſalt with it.

	ther.		winds	
Mar. 8, 1730	40	0	S 3	Cloudy weather and a ſtrong S. wind. *Veſuvius* ſent forth a great ſmoke and ſtream of fire with hollow rumbling.
9	38	0	W 1	The weather cloudy. The following night *Veſuvius* thunder'd, as it were, twice: In the day the windows trembled a little.
10, 11, 12	39	0	S 1	Cloudy: Rain at times: The clouds hide the ſmoke and fire.
13	41	1	NW 1	The weather rather clear: The ſmoke leſſen'd.
14	47	0	N 2	A little rain in the night; in the morning ſnow in the mountains; in the forenoon the ſnow increaſed again. After 8 o'clock in the evening the fire aroſe to a vaſt height, and threw huge ſtones to almoſt half the perpendicular height of the mountain. Pumice-ſtones red hot, of 2 or more ounces weight, were driven ſeveral miles like a ſhower of hail, and frightned away the birds. In about an hour's time the height of the flame was ſomewhat leſſen'd; and flaſhes of lightning were ſeveral times obſerved thro' the middle of the thick ſmoke.

Mar.

Mar.	ther.		winds	
15	30	0	N E 1	Clear weather: Thick ſmoke ſcattered the aſhes ſeveral miles over the ſea.
16	48	0	S 1	Clear in the morning; cloudy about noon, ſmall rain and cold: By change of the winds the ſmoke and aſhes were carried towards the N. clouds hide the mountain.
17	40	1	S 1	A few thin clouds: The ſmoke turn'd with the wind.
18	40	0	S S W 1	Clear. The city of *Naples* was ſprinkled over with ſmall aſhes, like kitchen aſhes, which were attracted by the loadſtone.
19	42	0	W 1	A few thin clouds.
20	37	0	0	Almoſt clear. *Veſuvius* became entirely quiet.

Obſervations made on Board the Chatham-Yatch, Aug. 30, 31 *and* Sept. 1. 1732 *in purſuance of an Order of the Lords of the Admiralty for the trial of the Inſtrument for taking* Angles; *by Mr.* Hadley. Phil. Tranſ. N° 425. p. 341.

IN *Phil. Tranſ.* N° 420. p. 147. Mr. *Hadley* communicated to the *Royal Society* the deſcription of a new inſtrument for taking angles, and produced a ſpecimen of an inſtrument made accordingly. Several of the Gentlemen to whom it was ſhewn, as well then as at other times, entertained a favourable opinion of the probability of its uſefullneſs, particularly Dr. *Halley* and Mr. *Bradley* not only expreſſed their deſire that trial ſhould be made of it at ſea, but promis'd the favour of their company and aſſiſtance on that occaſion.

The inſtrument produced at the *Royal Society* was made of wood, and was intended chiefly for taking altitudes of the ſun, moon, and ſtars from the viſible horizon, either forwards or backwards: Mr. *Hadley*, therefore, procur'd another to be made of braſs by Mr. *Siſſon*, for taking the diſtance of any kind of objects. It is ſupported by a ſingle ſtem ſcrew'd on to it on the under ſide, the lower end of which may reſt on the ground, to eaſe the obſerver of the weight of the inſtrument. This ſtem is alſo made to lengthen or ſhorten, by which means the inſtrument is brought to the proper height for any obſerver's eye, either ſtanding or ſitting. Inſtead of a ball and ſocket, it has 2 circular arches fixed on its back, by which it is readily

ſet

ſet to any poſition, which the ſituation of the objects may require.

The commiſſioners of the Admiralty having been pleaſed to order the *Chatham Yatch* for the trial of the ſaid inſtrument, and to give directions to Mr. *Young*, Maſter attendant at *Chatham*, a Gentleman well ſkilled in navigation, to be preſent at the trial, Mr. *Hadley*'s 2 brothers and himſelf went on board accordingly *Aug.* 30, being favour'd with the company of Sir *Robert Pye* and Mr. *Ord.* Mr. *Young* met them at *Sheerneſs* the next day, and accompanied them down about 3 leagues below the *Nore*, near the *ſpile-ſand*, and was on board on *Friday* *Sept.* 1. when they lay by there, and the ſeveral altitudes of the ſun were taken as he approached the meridian from about 10 o'clock till noon.

The obſervations were, as follows.

	°	′	″
Aug. 30. near midnight, Mr. *Bradley* obſerved the diſtance of *Lucida lyræ* from *Cor aquilæ* by the braſs-inſtrument off *Graveſend* in ſtill water.	34	13	30
The ſame repeated was	34	13	15
The error of the inſtrument in that place is 23″ to be ſubſtracted.			
The diſtance of thoſe ſtars, according to Mr. *Flamſtead* is	34	11	50
Which by the refraction is reduced to	34	11	10
Aug. 31, about 10ʰ 30′ Mr. *Bradley* did with the ſame inſtrument obſerve the diſtance of *Capella* from the *north pointer* in the back of the *great bear*; while they lay at anchor in the mouth of the *Medway* near *Sheerneſs*, the wind blowing hard at N. E.	49	14	00
or	49	15	00

Mr. *Bradley* and Mr. *Hadley* making a ſmall difference in numbering the degrees of the angle markt by the index.

The error of the diviſion of the inſtrument there, is 30″ to be added.

	°	′	″
The diſtance of thoſe ſtars, according to Mr. *Flamſtead* is	49	16	00
By the refraction reduced to	49	14	20

Clouds coming up prevented the repeating this obſervation; nor had they any opportunity of making any others of this kind.

Tho

The following altitudes were obſerved by Mr. *Bradley*, lying at anchor in the mouth of the *Medway*, *Aug.* 31, in the afternoon, the wind at N. E. a freſh gale by the wooden inſtrument forwards. The watch by the mean of the obſervations appeared to be about 8 45″ too ſlow; the viſible horizon being ſuppoſed 3′ 30″ depreſs'd below the true horizon by the height of the obſerver's eye above the ſurface of the water, amounting to about 8 or 9 feet.

Time by watch.	True time.	True alt. of ſun's upper limb from the viſible horizon.	Refraction, add.	Appt. alt. of ſun's upper limb from the viſible horizon.	Alt. of the ſun's upper limb obſerved.	Errors of diviſion of the inſtr. ſubſtr.	Obſerved alt. of the ſun's upper limb corrected.	Errors of obſervation.
h. ′ ″	h. ′ ″	° ′ ″	′ ″	° ′ ″	° ′ ″	′ ″	° ′ ″	′ ″
5 11 50	5 20 35	9 50 31	4 54	9 55 25	9 57 00	2 15	9 54 45	—0 40
16 30	25 15	7 00	5 17	12 17	13 30	2 15	11 15	—1 2
18 20	27 5	8 49 52	5 27	8 55 19	8 57 30	3 00	8 54 30	—0 49
21 20	30 5	21 51	6 44	27 35	30 00	3 00	27 00	—0 35
28 5	36 50	7 18 44	6 28	7 25 12	7 27 30	2 00	7 25 30	+0 18
30 35	39 20	6 55 22	6 46	2 8	5 00	2 15	2 45	+0 37
32 25	41 10	38 13	7 3	6 45 16	6 48 00—	2 15	6 45 45—	+0 29—
36 30	45 15	00 00	7 40	7 40	10 00	2 15	7 45	+0 5
38 37	47 22	5 40 11	8 3	5 48 14	5 51 00	2 15	5 48 45	+0 31
40 35	49 20	21 50	8 24	30 14	34 00—	2 15	31 45—	+0 31—
42 34	51 19	3 14	8 50	12 4	15 00	3 00	12 00	—0 4
43 50	52 35	4 51 24	9 7	00 31	3 30	3 00	00 30	—0 1

The following altitudes of the sun were obſerved *Sept.* 1, before noon, under ſail from *Sheerneſs* towards the ſpile-ſand, with the tide of ebb, the wind blowing hard at N. E. by the wooden inſtrument forward. The 2d *ſpeculum* being removed by ſome accident from its due poſition; ſo as to increaſe the angles obſerved about 1° 3′ and ½; as appeared by the firſt obſervations of the afternoon of the ſame day, made with the ſame inſtrument, in the ſame manner, while they continued lying by near the *ſpile*; and that degree and three minutes and a half are added to the errors of the diviſions of the inſtrument in the ſeventh column. While theſe obſervations were making, the yatch ſteered at firſt chiefly E. ſometimes S. E. afterwards ſtood to the N. E. towards the *Swin*. The time of the watch was regulated by ſome of the later obſervations made when they were moſt eaſtward; and this was probably the cauſe, why the firſt altitudes, which were taken while they were more weſterly, fall ſo much ſhort of the computations; the difference decreaſing gradually, as they advanced towards the eaſt.

Time

Altitudes obſerv'd by Mr. *Bradley*.

Time by Watch.			True Time.			True Alt. of the Sun's lower Limb from the viſible Horizon.			Re-fracti-on, add.		Appt. Alt. of the Sun's lower Limb from the viſible Horizon.			Altitude of the Sun's lower Limb obſerved.			Errors of the In-ſtrument ſubſtract.			Obſerved Altitude of the Sun's lower Limb corrected.			Errors of Obſervation.		
h.	'	"	h.	'	"	°	'	"	'	"	°	'	"	°	'	"	°	'	"	°	'	"	'	"	
7	9	15	7	18	15	15	5	39	3	15	15	8	54	16	9	00	1	5	45	15	3	15	— 5	39	
	11	44		20	44		28	13	3	11		31	24		33	00—	1	5	45		27	15—	— 4	9+	
	13	38		22	38		45	23	3	8		48	31		49	00	1	5	45		43	15	— 5	16	
	14	53		23	53		56	43	3	5		59	48	17	2	00	1	5	45		56	15	— 3	33	
	16	33		25	33	16	11	47	3	2	16	14	49		18	00—	1	5	45	16	12	15—	— 2	34+	
	18	4		27	4	25	5	31	2	59		28	30		32	00	1	5	45		26	15	— 2	15	
	23	54		32	54	17	18	00	2	50	17	20	50	18	25	00	1	6	30	17	19	30	— 1	20	
	25	38		34	38		33	31	2	47		36	18		43	00+	1	6	00		37	00+	+ 0	42+	
	28	25		37	25		58	23	2	43	18	1	6	19	7	00—	1	6	00	18	1	00	— 0	6+	
	30	44		39	44	18	19	4	2	40		21	44		28	00	1	5	00		23	00	+ 1	16	
	34	21		43	21		51	10	2	35		53	45	20	00	00	1	4	30		55	30	+ 1	45	
	36	24		45	24	19	9	18	2	33	19	11	51		16	00	1	4	30	19	11	30	— 0	21	
	38	44		47	44		29	54	2	30		32	24		38	00—	1	4	30		33	30—	+ 1	6—	un-
	40	30		49	30		45	27	2	28		47	55		52	00+	1	4	30		47	30+	— 0	25—	cer-
	42	00		51	00		58	41	2	26	20	1	7	21	4	00+	1	4	30		59	30+	— 1	37—	tain.
	45	34		54	34	20	29	51	2	22		32	13		35	00—	1	4	30	20	30	30	— 1	43	

The

The ſame continued by Mr. *John Hadley.*

Time by Watch.	True Time.	True Alt. of the Sun's lower Limb from the viſible Horizon.	Refraction, add.	Appt. Alt. of the Sun's lower Limb from the viſible Horizon.	Altitude of the Sun's lower Limb obſerved.	Errors of the Inſtrument ſubſtract.	Obſerved Altitude of the Sun's lower Limb corrected.	Errors of Obſervation.
h. ′ ″	h. ′ ″	° ′ ″	′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	′ ″
7 52 18	8 1 18	21 28 21	2 15	21 30 36	22 36 00—	1 4 30	21 31 30—	+0 54—
54 18	3 18	45 43	2 13	47 56	52 00	1 4 30	47 30	—0 26
55 40	4 40	57 25	2 12	59 37	23 4 00	1 4 30	59 30	—0 7
58 22	7 22	22 20 34	2 9	22 22 43	30 00	1 5 15	22 24 45	+2 2 uncert.
8 2 51	11 51	58 46	2 6	23 0 52	24 4 00	1 5 15	58 45	—2 7
9 19	18 19	23 53 26	2 0	55 26	25 0 00+	1 5 30	23 54 30+	—0 56—
13 10	22 10	24 25 35	1 57	24 27 32	32 00	1 5 30	24 26 30	—1 2
14 45	23 45	38 43	1 56	40 39	45 00+	1 5 30	39 30+	—1 9—
16 55	25 55	56 23	1 55	58 19	26 3 00	1 5 30	57 30	—0 49
19 5	28 5	25 14 34	1 53	25 16 27	22 00+	1 5 30	25 16 30+	+0 3+
22 57	31 57	46 14	1 51	48 5	52 00—	1 5 30	46 30—	—1 35+
25 5	34 5	26 3 35	1 49	26 5 24	27 10 00—	1 5 30	26 4 30—	—0 54+
26 43	35 43	16 50	1 48	18 8	22 00+	1 5 30	16 30+	—1 38—
28 20	37 20	29 54	1 47	31 41	35 00	1 5 30	29 30	—2 11

The

The following altitudes of the ſun were obſerv'd, lying by near the *Spile Sept.* 1. before noon, with the wooden inſtrument backward, the wind continuing to blow hard, as before, at N.E. The inſtrument, when us'd for the back obſervation, was ſo adjuſted, as to allow for a dip of the viſible horizon of two minutes and a half; conſequently, that dip being ſuppoſed, as before, three minutes and a half; there remains only one minute to be accounted for, in computing the height of the ſun, which is accordingly ſubſtracted in the third column from the altitudes found by computation. The watch now appeared to be 9′ 30″ too ſlow.

Altitudes obſerv'd by Mr. *John Hadley.*

Time by Watch.			True Time.			True Alt. of the Sun's upper Limb.			Re-fraction, add.		Appt. Alt. of the Sun's upper Limb.			Alt. of the Sun's upper Limb obſerved.			Errors in the Diviſion. Subſtr		Obſerved Altitude of the Sun's upper Limb corrected.			Errors of Obſervation.	
h.	′	″	h.	′	″	°	′	″	′	″	°	′	″	°	′	″	′	″	°	′	″	′	″
9	52	55	10	2	25	36	52	54	1	11	36	54	5	36	46	00	1	00	36	45	00	−9	5
10	2	7		11	37	37	43	37	1	9	37	44	46	37	44	00	1	00	37	43	00	−1	46
	6	0		15	30	38	4	0	1	8	38	5	8	38	4	0	1	00	38	3	00	−2	8
	8	53		18	23		19	0	1	8		20	8		22	0+	1	00		21	00+	+0	52+
	12	25		21	55		36	25	1	7		37	32		41	00	1	30		39	30	+1	58
	16	30		26	0		56	9	1	6		57	15	39	00	00	1	30		58	30	+1	15
	18	50		28	20	39	7	7	1	6	39	8	13		6	00	0	30	39	5	30	−2	43
	20	40		30	10		15	26	1	6		16	32		14	00	0	30		13	30	−3	2

The

The ſame continued by Mr. *Bradley*.

Time by Watch.			True Time.			True Alt. of the Sun's upper Limb.			Re-fraction, add.		App. Alt. of the Sun's upper Limb.			Alt. of the Sun's upper Limb obſerved.			Errors in the Diviſion Subſtr		Obſerved Altitude of the Sun's upper Limb. corrected.			Errors of Obſervation.	
h.	′	″	h.	′	″	°	′	″	′	″	°	′	″	°	′	″	′	″	°	′	″	′	″
10	30	18	10	39	48	39	57	28	1	4	39	58	32	4	00	00	2	00	39	58	00	—0	32
	33	23		42	53	40	10	2	1	4	40	11	6		12	00	2	00	40	10	00	—1	6
	35	53		45	23		19	51	1	4		20	55		16	00—	2	00		14	00—	—6	55+
	37	48		47	18		27	13	1	3		28	16		32	00—	2	30		29	30—	+1	14—
	39	22		48	52		33	3	1	3		34	6		36	00	2	30		33	30	—0	36
Continued by Mr. *Henry Hadley*.																							
11	8	5	11	17	35	41	59	36	1	00	42	00	36	42	15	00+	2	30	42	12	30+	+11	54+
	16	20		25	50	42	16	36	1	00		17	36		20	00	2	30		17	30	—00	6
	22	0		31	30		25	48	0	59		26	47		31	00	2	45		28	15	+1	28
	24	20		33	50		29	35	0	59		30	34		34	00	2	34		31	15	+00	41
	28	00		37	30		34	27	0	59		35	26		39	00	2	45		36	15	+00	49
	33	45		43	15		40	32	0	58		41	30		45	00—	3	00		42	00—	+00	30—
	37	45		47	15		43	43	0	58		44	41		48	00+	3	00		45	00+	+00	19+
	40	30		50	00		45	25	0	58		46	23		49	00	3	00		46	00	—00	23
	43	00		52	30		46	34	0	58		47	32		51	00	3	00		48	00	+00	28
	47	00		56	30		47	42	0	58		48	40		52	00	3	00		49	00	+00	20
	again.														52	00	3	00		49	00	+	
	again.		12	00	00		48	2	0	58		49	00		52	00	3	00		49	00	00	00

Between

Between each of the five laſt of theſe obſervations, the index of the inſtrument was remov'd; ſo as to make them entirely independent of one another; and from their near agreement among themſelves; and with good part of the preceeding, Mr. *Hadley* concludes the true height of the ſun's centre above the real horizon at noon to be exactly enough 42° 33'; his ſemidiameter being 16 minutes: From which and the ſun's declination, namely 4° 1'; the latitude of the place will be 51° 28'; which is accordingly uſed in all the computations.

By the wooden inſtrument forwards, the ſecond ſpeculum remaining diſplac'd as in the morning; the following altitudes of the ſun were obſerv'd *Sept.* 1. 1732, afternoon, near the *Buoy of the Spile*, and under ſail weſtward.

Altitudes

Altitudes obferv'd by Mr. *Bradley*.

Time by the Watch.			True Time.			True Alt. of the fun's lower Limb from the vifible horiz.			Refraction add.		App. alt. of the fun's lower limb from the vifible horizon.			Altitude of the fun's lower limb obferved.			Errors of the Inftrument fubftract			Obferved alt. of the fun's limb correct.			Errors of obfervation.		
h.	′	″	h.	′	″	°	′	″	′	″	°	′	″	°	′	″	°	′	″	°	′	″	′	″	
12	7	30	12	17	00	42	12	13	1	00	42	13	13	43	20	00	1	6	0	42	14	00	+0	47	
	8	30		18	00		11	9	1	00		12	9		19	00	1	6	0		13	00	+0	51	
	12	00		21	30		7	18	1	00		8	18		13	00	1	6	0		7	00	—1	18	
	19	50		29	20	41	56	00	1	00	41	57	00		1	00	1	6	0	41	55	00	—2	00	
The fame continued by Mr. *Henry Hadley*.																									
1	00	00	1	9	30	40	9	21	1	3	40	10	24	41	13	00	1	6	0	40	7	00	—3	24	uncert.
	1	35		11	5		3	20	1	4		4	24		10	00	1	6	0		4	00	—0	24	
	3	2		12	32	39	57	59	1	4	39	59	3		4	00	1	6	0	39	58	00	—1	3	
	4	21		13	51		52	57	1	4		54	1		2	00	1	6	0		56	00	+1	59	
	6	14		15	44		45	31	1	4		46	35	40	52	00	1	6	0		46	00	—0	35	
	7	30		17	00		40	28	1	4		41	32		49	00	1	6	0		43	00	+1	28	
	8	43		18	13		35	37	1	5		36	42		40	00	1	6	0		34	00	—2	42	uncert.
	10	00		19	30		30	28	1	5		31	33		38	00	1	6	0		32	00	+0	27	
	11	29		20	59		24	22	1	6		25	28		34	00	1	6	0		28	00	+2	32	
	14	23		23	53		11	46	1	6		12	52		18	00	1	6	0		12	00	—0	52	

The first and sixth columns of the preceeding tables of observations are copied from the minutes, as they were set down at the time. The divisions of the wooden instrument not being exact, Mr. *Hadley* found it necessary to make a table to correct them by, which was done partly by measuring with compasses, and partly by examining them against those of another instrument. The corrections were every where to be substracted from the angles observ'd and the errors of one degree and three minutes and $\frac{1}{2}$, occasion'd by the misplacing the 2d speculum in all the forward observations of *Sept.* 1. being of the same kind, are joined with them, in the 7th column of the tables of those observations. The last column contains the differences between the observ'd altitudes, corrected by the forementioned table, and the altitudes as they ought to have appear'd by the computations. Among them there are 2 or 3, which so much exceed any of the rest, that for that reason they seem rather to be owing to mistakes, in counting the minutes on the instrument, or the time by the watch, than to the errors of the observations.

The greatest part of the altitudes were taken by a horizon not clear of land: and by that means not always so readily distinguishable: The observers were all persons quite unaccustomed to the motion of a ship at sea, which in this case was generally very great and quick; the vessel they were in being only of about 60 tuns burden, as the master informed; the smallness of which made it also more liable to be lifted up and let down again by the waves: And if the difference of height occasion'd by that means was about 4 or 5 feet, as it was judged to be, it must necessarily sink and raise the visible horizon by turns near one minute. The computations of the sun's altitudes are all made for the Lat. of 51° 21′; whereas a good part of them were taken under sail, and upon different tacks; rhe vessel sometimes standing N. E. or N. at other times S. E. for near a quarter of an hour at a time.

Several of these circumstances may, probably, have contributed to increase the inconsistency of the observations: But as no particular notice was taken of them at the time, Mr. *Hadley* contents himself with only mentioning them.

The principle, on which the contrivance of this instrument depends, was laid down in *Phil. Trans.* N° 420, in one proposition and several corollaries; the 5th of which contains the grounds of an approximation for correcting some small errors, which

which will arise, if the plane of the instrument be suffer'd to vary too much from the great circle passing thro' the 2 objects, when the observation is taken. There appears reason to think, that there will be very little occasion in practice for that correction; but it was necessary to mention it, in order to explain the nature of the instrument: And as the manner of deducing that corollary from the proposition may not appear obvious to every reader, Mr. *Hadley* has here annex'd the demonstration of it.

Let O B C (Fig. 11. Pl. IX.) represent an infinite sphere, at whose centre R are placed the 2 specula, inclin'd to each other in any given angle, and let your common section coincide with the diameter O R C: Let B A N be the circumference of a great circle (to the plane of which the common section of the specula O R C is perpendicular) and B R its radius: Let *b a n* be the circumference of a circle parallel to B A N, and at the distance B *b* from it: Draw *b* D the sine, and *b r* the sine complement of the arch B *b*; B D is the versed sine of the same. Let A be a point of an object, placed in the circumference of the great circle B A N, and N the point in which its image is formed by the 2 successive reflections, as before described; and let *a* be a point of another object placed any where in the circumference of the parallel *b a n*, and *n* its image; and let *a h n* be an arch of a great circle passing thro' the points *a* and *n*: The point *a* is at the same distance from the great circle B A N, as the point *b*, *i. e.* at the distance B *b*. Draw A R, A N, R N, *a r*, *a n*, *r n*, *a* R and *n* R.

By the 4th *Coroll.* the figures A R N and *a r n*, are similar; and consequently, the line A N is to the line *a n*, as A R or B R is to *a r*, or *b r*, *i e.* as the radius to the sine complement of the distance B *b*. But A N is the chord of the arch A H N of the great circle B A N, equal to the translation of the point A, or double the inclination of the specula, and *a n* is the chord of the arch *a h n* of a great circle, measuring the angle *a* R *n*, by which the point *a* appears remov'd by the two reflections, to an eye placed in the centre R. Therefore, the translation, or apparent change of the place of the point *a* is measur'd by an arch of a great circle, whose chord is to the chord of the arch A H N (equal to double the inclination of the specula) as the sine complement of its distance from the great circle B A N is to the radius.

From

From any point C of the circumference O B C draw the chords C M and C *m* to the same side of the point C, and equal to the chords A N and *a n* respectively, draw the radius R M; and from R and *m* draw R Q, and *m* P, both perpendicular to CM, and cutting it in Q and P: R Q is the sine complement, and C M double the sine of half the angle M R C, or A R N, or of the angle of inclination of the specula. The little arch M *m* will represent the difference of the apparent translations of the objects in A and *a*; and if it be very small, may be looked on as a streight line, and the little mixed triangle M *m* P as a rectilinear one, which will be similar to R M Q, because R M is perpendicular to M *m*, and R Q to C M, and the angles at Q and P right angles. The line C P may be taken as equal to C *m*, and M P as the difference of the lines C M and C *m*. Therefore, the little arch M *m* is: to the line M P:: nearly as R M: to R Q: But C M (*i. e.* A N) was: to C *m*:: (*i. e.* *a n*) as B R: to *b r*; and the difference M P of C M and C *m*: to the difference B D of B R and *b r*: as C M: to B R; therefore, M *m*, the difference of the apparent translations, is to B D, the versed sine of the distance B *b*, or to an arch equal to it, in the compound ratio of R M the radius to R Q the sine complement of the angle of inclination of the specula, and C M double the sine of the same, to B R the radius, *i. e.* as C M to R Q.

The observation may be corrected by one easy operation in trigonometry, as will appear from the first part of this *Coroll.* *viz.* by taking the half of the angle observ'd, and then finding another angle, whose sine is to the sine of that half, as the sine complement of the distance B *b* is to the radius; this angle doubled will be the true distance of the objects. But as this operation, tho' easy, will require the use of figures, Mr. *Hadley* rather chose the method of approximation; because by that the observer retaining in his memory the proportions of the sines of a few particular arches to the radius, may easily estimate the correction without figures, when the angle is not great; and by a line of artificial numbers and sines, may always determine it with greater exactness than will ever be necessary.

When the angle observ'd is very near two degrees, the correction may be omitted; for, then it will be easy to keep the plane of the instrument so near that of the before mention'd great circle, as not to want any, if the situation of that circle be be known. If it be not, the obſerver, when he ſees the 2 objects together, may turn the inſtrument on the axis of the teleſcope, till he find that poſition of it by which he obtains the leaſt angle; and this (if the ſpecula be ſet truly perpendicular to the plane of the inſtrument) will always happen, when the objects appear to coincide in the line *g h*, as repreſented in Fig. 6. Pl. VII. of Phil. Tranſ. N°. 420. p. 147.

In that *Tranſaction* a rule is given for finding to which hand of the obſerver the object ſeen by reflection ought to lie, but is reſtrained to the particular form of the inſtrument there deſcribed. The general rule is, that when the index is brought to the beginning of the ſcale (*i. e.* to 0°, when the inſtrument is deſigned for angles under 90°, or to 90°, when is is deſigned for angles from 90° to 180°) if then a line be imagined to be drawn thereon parallel to the axis of the teleſcope, or line of direction of the ſight, ſo as to point towards the object ſeen directly; which way ſo ever this line is carried by the motion of the index along the arch from 0° towards 90° in the firſt caſe, or from 90° towards 180° in the ſecond; the ſame way the object ſeen by reflection ought to lie from that which is ſeen directly.

A Regiſter of Meteorological, Barometrical, Thermometrical, Epidemical and Magnetical Obſervations, made at Utrecht *in* 1729; *by M.* Muſchenbroek. Phil. Tranſ. N°. 425. p. 357. *Tranſlated from the* Latin.

THESE meteorological *ephemerides* are for each year ſet down in a large table, containing 12 *areolæ*, one for each month; of which that for *January* 1731 is a ſpecimen, as repreſented in Fig. 1. Pl. X. But becauſe all the ſigns, or characters, made uſe of in the other parts of the table do not occur in this month, there are other ſpecimens of ſome few days of different years annex'd, as in Fig. 7. which take in all the variety of ſigns; at the bottom of Fig. 1. are explained the different characters made uſe of in deſigning the meteors; whence will be eaſily and at firſt view underſtood, all that is neceſſary in conſtructing this kind of meteorological tables. But ſince a full account of what is ſet down in theſe journals would be too prolix M. *Muſchenbroek* rehearſes only the moſt remarkable things.

On the left ſide of the table is ſet down the month; to the right of this the numbers that denote the height of the baro-

meter

meter in *Rhinland* inches and lines; they begin at the bottom from 28, and end at 30; becaufe in *Holland* the Mercury is feldom lower than 28 inches, and very rarely rifes to 30 inches: The whole variety, therefore, in the height of the mercury in the barometer, is commodioufly comprifed within thefe numbers; and that by means of a fingle point put exactly in the place, which expreffes the height of the mercury: The barometrical obfervations were taken thrice every day, at 7 in the morning; at noon, and at 11 in the evening, at which times the heights of the thermometer were likewife obferved; the thermometer made ufe of was a mercurial one, made by M. *Fahrenheit*, according to his own table, the method of whofe conftruction is given in M. *Mufchenbroek's* commentaries on the florentine experiments: The fcale is fuch, as that the mercury in the tube defcends to the beginning of the degrees, or 0, when in winter the thermometer is put into fnow mixed with fal ammoniac; from thence it rifes up to 32 degrees, when water begins to freeze; and to 214 degrees, when the tube is immerfed in boiling water: Thefe few remarks are fufficient. This thermometer always remains fufpended in the open air, but fhaded from the fun; fo as truly to fhew the degree of heat, or cold of the atmofphere. In the meteorological table you fee the number 29 for the barometer, from which thro' the middle of the month towards the right are written the days of the month from 1 to 31, which with their numbers are diftinguifh'd by blacker lines; each day is divided by 2 finer intermediate lines into 3 fpaces, deftin'd for 3 obfervations for every day, taken at the time aforefaid: The thermometrical obfervations are fet down in the uppermoft row, of the month from the left to the right hand: The winds, their coafting and ftrength in the 2d, and the quantity of rain in the third; this laft M. *Mufchenbroek* collects in the fame manner as in the obfervatory at *Paris*: The numbers in the 4th row denote the quantity of water, that evaporates out of an open veffel, in a fhaded place: This veffel is an exact parallelopiped made of lead, each of whofe uppermoft fides is 6 inches and its height 18 inches; this veffel is filled every month 16 inches high, and always within 2 inches of the brim. In another row the phafes of the moon are fet down in order to obferve the changes this planet might caufe in our atmofphere. In fine, in the eleventh row is fet down the inclination of the magnetic needle at noon: This needle is 4 foot long, and inferior

ferior to none in perfection, and described in his *Magnetical Dissertations* p. 190. And lastly, in the lowest rank, is set down the declination of a magnetic needle, six inches long, and included in a machine delineated *ibid.* p. 233. This machine stands upon a large flat stone, in the middle of his garden; so that the right line, which passes thro' N, and S. insists upon the true meridian line; and thus may at any time with great ease and without any trouble be observed the declination of the magnetic needle: He always made choice of noon, that he might the better compare the inclination with the declination. This is sufficient for understanding the meteorological tables; and now he subjoins other things which could not be inserted in the tables, and which he observed over and above what is set down there.

In *January* there was an intense cold, especially on the 6th, 11th and 19th days; and he doubts whether any one ever observed a sharper frost in these parts, the thermometer falling to the fourth degree: In the mean time from the 1st to the 15th of *January* the mercury was lower in the barometer, than it usually is in frosty weather: Besides, it freez'd, from whatever quarter the wind blew, which is a pretty rare case; commonly a day or two preceeding the phasis of the moon, whether at the full, new, or in her quadratures, the weather changed by the frost's remitting a little: This planet has so great an influence on our atmosphere, that when she begins to gravitate most towards our earth, and our earth to gravitate towards her, the clouds seem to be condensed, and the vaporous particles collected together to become heavier, than that they can be sustained in *æquilibrio* by the atmosphere; and so they fall down in the form of rain, snow, or hail, and raise winds, which by their attrition produce heat, and cause a thaw. The form of the snow that fell on the forenoon of the 6. of *January* was remarkable: it was all rosaceous stellate, or consisting of parts of stars half formed or broken off: M. *Muschenbroek* carefully view'd it with a microscope; it seemed to be of four species, yet all of them hexagonal, nearly resembling that observed by *Des Cartes* at *Amsterdam* in 1673, but delineated much more accurately by Dr. *Hook* in *Pl.* 8. of his *Micrograph.* p. 88. or by *Cassini* in the *Memoirs of the Royal Academy of Sciences* for 1692. M. *Muschenbroeck* accurately delineated the figures of the snow he himself observed, one of which (Fig. 2.) resembles a rose: the greatest part thereof was of different sizes: For, some were

$\frac{7}{100}$ of a *Rhinland* inch in diameter; others $\frac{10}{100}$ and others $\frac{11}{100}$; some flakes were branchy, (as represented in Fig. 5.) and $\frac{200}{10}$ or $\frac{21}{100}$ of a *Rhinland* inch in diameter. M. *Muſchenbroeck* does not remember, he ever obſerved any like it: With it he filled a veſſel of a parallelopiped form, 12 inches high, and ſetting it in a warm place, it yielded half an inch of melted ſnow: So that this ſnow was 24 times rarer than water; an unuſual rarity indeed! *Sedilavius*, *De la Hire* and others have obſerv'd that rare ſnow is ſix times lighter than water; but again *De la Hire* obſerved that very rare ſnow is 12 times lighter; and yet M. *Muſchenbroek* obſerved it twice rarer ſtill: He would not take upon him to determine how this hexagonal ſnow is produced; the various opinions about it may be ſeen in *Cartes. princip. philoſ. Kepler de Nive ſexangul. Eraſmus Bartholin. de fig. nivis Milliet. in tract. de meteor.* as alſo in *Phil. Tranſ.* N° 92, 376. The fall of this ſnow brought along with it terrible cold and froſt, eſpecially, after five in the evening, which laſted after 12 at night: In all this time, wine, taken out of a deep cellar and put in a corner of a room, where there was a large fire, froze immediately; nay, ſcarce did it ceaſe freezing, when pour'd into glaſſes, that ſtood on a table, not far from the fire. In like manner whatever could be turned into ice, became unhappily rigid. A like cold pinch'd every thing on the 11. of the ſaid month; but by a kind providence its duration was ſhort, whereby ſeveral animals and vegetables were preſerved from deſtruction. A very rare ſort of ſnow, of the ſecond form, mentioned above, fell on *Jan.* 8. at three in the afternoon, conſiſting only of oblong *ſpicula*, ſcarce $\frac{1}{10}$ of an inch; in other reſpects very ſlender, and conſequently, very ſimple flakes of ſnow.

The froſt laſted till the 22. whereby the ice became ſo thick, that upon meaſuring it in ſome larger ditches of ſtanding water M. *Muſchenbroek* found it 20 *Rhinland* inches thick; in rapid ſtreams its leaſt thickneſs was 12 or 13 inches: Yet however thick it was, it was entirely diſſolved on *Feb.* 1. ſo that there was ſcarce any trace thereof in ſeveral ditches in the ſuburbs of *Utrecht*; this ſudden thaw was owing to a great deal of rain that fell after the 22.

In

In the beginning of *January*, here and there a kindly sort of measles slightly affected young children; very few or none of them dying.

And during all the time of the frost, till it began to remit, the city was scarce infested with any distemper; the cold driving both the fire, as it were, and the seeds of all kinds of disorders out of the air: But as soon as it thaw'd, that is, on the 24. of *January*, *angina*'s and burning fevers began the tragedy; when those bodies, that before were constringed by the severe frost, were now suddenly relaxed by the rainy, warm and moist air, agitated by stormy winds: For, on the very noon of the coldest day the heat increased from 8 to 44 degrees on the warmest day, according to the scale of the thermometer; a change of heat so sudden that human bodies could not possibly bear it without affecting their health. But we are chiefly to attend to the considerable change in the height of the atmosphere; for, the mercury in the barometer fell so swiftly in the night between the 24. and 25, that M. *Muschenbroeck* scarce ever remembers a swifter descent; and it stood almost at the lowest state, a little above 28 inches: Since, therefore, the blood-vessels of the human body, that were before compressed by the great weight of the atmosphere; and still more constringed by the very intense cold, were now very suddenly relaxed, both by the heat and inconsiderable weight of the atmosphere, the blood must necessarily by that means rush into vessels, so suddenly open'd, and not designed for transmitting it; and cause an inflammation, a fever and other symptoms.

M. *Muschenbroek* here subjoins a short history of *angina*'s, which prevail'd at that time; and because they are not always of the same nature, he, therefore, takes this history from his own observations: The healthiest and such as had no signs of any ailment upon them before, were suddenly seised therewith in the middle of the night; the right almond of the ear, as was generally the case, was suddenly inflamed; then immediately the fever came on, with a head-ach, a rigor in the neck and back; and these parts felt as cold, as if they were plunged in cold water; the following day the fever continued at the same pitch and with the same rigor in the back: Some, who were seised with a slighter fever, falling the ensuing night spontaneously into a plentiful sweat, got up well in the morning, and entirely free from the disorder, but weaken'd more than is usual after a fever of such short duration; and this circumstance gave some suspicion of some latent malignity: Others were not so lucky; for, labour-

labouring under a feverer fever, their *angina* increafed till the third day, tho' a plentiful venifection and cathartics were ufed from the beginning of the diforder; yet repeated two or three times they gave relief the third day: In the mean time the urine was of a flame-colour, and remarkably fetid; they neither fweat, nor flept; they had a violent head-ach, and a laffitude over all their joints, as if they had been beaten; the tongue was fcarce difcolour'd: The diforder went off in fome on the fifth day, its crifis a plentiful fweat, whilft the urine continued reddifh and limpid all the time. This *angina* feifed both infants and adults without diftinction: Many who were cur'd of the *angina* after two days, had the continual fever recur, of which they did not recover in fix or feven days. For fome years back M. *Mufchenbroek* obferved, that in winter after a froft, *angina's* were frequent, as foon as it began to thaw; efpecially, if the thaw were fudden.

Befides, there raged other continual burning fevers; which were daily heightened with a new cold fit about evening. The tongue was dry and black; they had great thirft, watchings, *delirium's*, violent head-aches, during the whole diforder; the eyes were fixed, and immoveable, as it were, with the appearance of flafhes of light before them: Some had a ftiffnefs in the lower part of the *abdomen*, and fuch made water with difficulty; the necks of others were entirely ftiff; and the whole bodies of others as ftiff as ftatues; and fuch could neither fee, hear, or ftir for two days before they died. Some had frequent convulfions a few days before death: Moft of them died on the 14. day, from the firft onfet of the diforder: He obferved no one efcape, who had not large quantities of blood taken away in the beginning; tho' they afterwards ufed diluent, moiftening, and cooling medicines: But fuch generally efcaped, as had large and repeated venifections, and the blood thus taken feemed not to differ much from that in a natural ftate, having fcarce any figns of an inflammation. The weaker fometimes had numerous yellow *aphthæ* that proved infallibly mortal: This fever was obferved both in infants and adults.

At noon M. *Mufchenbroek* daily obferved both the inclination and declination of the magnetic needles; and he wondred that the declination did not change at the fame time with the inclination; and this was the cafe not only for this month of *January*, but alfo for the whole three years he had made thefe obfervations. On the firft of *January* he communicated new virtue to both needles, that he might likewife obferve how long the

the virtue would continue undiminiſhed in iron; in a pretty generous inclinatory needle, it continued for two years and a half, and no longer: But how long it will continue in the common ſea-compaſs needles, he could not determine by reaſon of the accident to be mentioned hereafter; yet he doubts not but that the virtue will laſt as long as the former: For, common ſea-compaſſes are known to retain their magnetic virtue from *Holland* to the *Eaſt Indies* and back again: As to the winds, you may obſerve that they have no influence on the magnet; for, the inclination and declination vary for two days ſucceſſively, tho' the ſame wind happen to blow; and at other times, when the wind blows from a different quarter for two ſucceeding days the inclination and declination continue invariable for that time: Much leſs has fair weather, rain, ſnow, or ſtorm, any influence on the magnetic virtue; for M. *Muſchenbroek* obſerved ſeveral times, that both the inclinatory and declinatory needle had an oſcillatory motion for a whole month together; at one time the inclination was greater, and at another time leſs; and that declination, which now is to the weſt, increaſes one day, and decreaſes the next, and becomes greater the day after. The difference between the leaſt inclination, which was 67°, and the greateſt, which was 68° 28′, is 1° 28′. The difference of the leaſt declination to the weſt, namely 12° 40′, and the greateſt, 13° 20′, is 40′.

Feb. 8. there was a halo about the moon from 7 till ½ an hour after 9 in the evening; its diameter was 3 and ½ times greater than the apparent diameter of the moon: This is commonly reckon'd to prognoſticate an approaching ſtorm; but this ſeems to be without any foundation: For, it was calm the ſucceeding day.

On the 25. ſeveral people were affected with *coryza*'s, from a great degree of heat in the air (conſidering the time of the year) from the 20. to the 24. which relaxed the whole human frame; the night of the 24. came on cold with a northerly wind, whereby the veſſels of the body were immediately conſtringed, and an inflammation cauſed in the membranes moſt expoſed to the air: M. *Muſchenbroek* ſcarce ever obſerved any *coryza*'s more obſtinate than theſe, the inflammation of the *membrana Schneideriana* reaching from the *aſpera arteria* to the lungs; this cauſed a cough, which in the day-time, it is true, was mild and not ſo frequent, but was heighten'd from 11 at night till 3 in the morning, from which time growing milder, it ſuffer'd the patient to reſt; this troubleſome cough continued for

for three or four weeks, and upwards, without yielding to any remedies, as veniſection, cathartics, ſudorifics, emollients, narcotics, expectorating, and moiſtening medicines; what ſometimes anſwered beſt, was a revulſion made by means of tents of *Braſil* tobacco; which put into the noſe caus'd a very great irritation, and derived the ſharp matter towards the noſtrils: Such cough, as would not yield to this remedy, was cur'd only by length of time. The greateſt inclination of the magnetic needle was 69° 30′, the leaſt 68° 25′; the greateſt declination 13° 20′, and the leaſt 13° 10′.

March 27, at ½ an hour after 10 in the evening, M. *Muſchenbroek* obſerved the firſt *aurora borealis* for this year, attended with ſomewhat unuſual phenomena: From the northern quarter of the heavens towards the weſt as far as the N. W. b. N, and in like manner from the north towards the eaſt, as far as the N. N. E, and from the horizon to the height of 20°, the ſky was overcaſt with a very thin cloud, and ſo rare, that ſtars of the ſecond and third magnitude ſhone thro' it, yet it was remarkably bright; its ſuperior limb was defined by an uneven edge; ſomewhere from its middle aroſe a column, perpendicular to the horizon, 10° above its uppermoſt limb, and paſſing thro' the middle of *Caſſiopeia*; its light was equable, ſtill and immoveable, and laſted very long; nay, no rays or fiery columns were ſhot from the cloud, as uſually happens in ſuch *aurora*'s: This *aurora* therefore was unuſually calm; and beſides, the ſky was exceeding ſerene, with a pretty ſtrong eaſterly wind of the ſecond degree of ſtrength; and yet the matter of the *aurora* hung perfectly ſtill above the region of this wind; ſuch ſort of matter, therefore, either on account of its lightneſs, or rarity, ſeems to aſcend to a conſiderable height in the atmoſphere; and this may likewiſe be eaſily prov'd from other obſervations.

Next day the remains of this *aurora* ſtill continued, forming only a thin *nubecula*, ſcarce ſhining, and not above 20° above the horizon; it emitted neither ſhining rays, or columns, nor extended far from the north either to the eaſt or weſt; it ſtill ſhone at midnight, and afterwards evaniſh'd without leaving any trace behind.

Scarce was any month ever drier than this, the quantity of rain being only 1 line and ¼: In the beginning it freezed pretty hard; ſo that on the 10. of *March* the ice was ſo thick in all the ditches, that it could bear ſkating on, and all the ſhipping was blocked up: But on the 12. the froſt remitting ſomewhat, and the heat of the ſun ſo ſtrong in the day time, it was great part melted on the 13. and this very evening, a ſhip ſet ſail from *Utrecht* to *Amſterdam*; but ſo keen a froſt, and ſudden a thaw, are things that rarely happen in theſe parts; ſuch a ſudden change in the air muſt neceſſarily have cauſed diſeaſes; nay, hence immediately ſprung pleuriſies and peripneumonia's, both which were of a kindly nature: For in the pleuretic diſorders the fever came on the firſt day; which was continual, but ſmall, with a ſlight pungent pain of the ſide, poſſeſſing the ſuperior and anterior part of the *thorax*; the day following the pain deſcended as far as the lower ribs, and all the while the ſpittle was yellow, mixed with bloody ſtreaks; the cough was neither troubleſome, nor frequent; the ſtools were natural, the ſleep good and refreſhing; the colour of the tongue was ſcarce changed; the thirſt little; the urine limpid, and not higher colour'd than uſual; all good indications of a kindly nature; on the third day the fever with all its ſymptoms entirely ceaſed: This pleuriſy was cur'd by a benign reſolution of nature, without veniſection, only taking down plentiful draughts of a ptiſan, uſing honey, and the lighter kinds of food. This diſorder afflicted chiefly the aged and adults.

At the ſame time *peripneumonia*'s made their appearance, beginning with a violent head-ach, a ſlight fever, ſome ſtraitneſs in the breaſt and a reſpiration ſhorter than ordinary: Yet were the patients in a ſhort time weakened, which might make one ſuſpect ſome latent malignity, had not the pleuriſies, that raged at that time, been ſo favourable: The blood in veniſection gave no ſigns of inflammation, but reſembled the natural; the urine was of a more intenſe red, the ſweat moderate, as alſo ſleep, which was quiet and always refreſhing; and now on the ſecond or third day after, there was a pretty heavy *nubecula* in the urine: The ſpittle was light and thin; the cough exceeding troubleſome, which encreaſed the head-ach; the thirſt moderate, the back of the tongue reddiſh, and the belly conſtricted; next day the fever was milder; the urine full of critical matter, and ſuch it continued for the following days; ſo that the diſorder entirely terminated in 7 or 8 days: But the cough laſted for 2 or 3 days longer; yet it was happily removed by the uſe of honey. This diſtemper ſcarce required the aſſiſtance of a phyſician, and went off either with or without veniſection, or adminiſtring any medicines. It is true, that about the latter end of *March*, the *peripneumonia* began to rage much fiercer, when it freezed in the night, with an eaſterly wind; but in the

day

day time the ſky being very ſerene, the air was pretty warm about noon, the thermometer ſtanding at 54, 58 and 59°. Human bodies ſeem ſcarce capable of bearing ſuch ſudden viciſſitudes of heat and cold, without falling into very acute diſorders: a very acute fever, therefore, heighten'd every day about the evening, together with a frequent cough, immediately ſeiſed the patients, and exceedingly inflamed the blood, as appear'd by veniſection: There were no peculiar ſymptoms throughout the whole courſe of the diſtemper; a greater number of patients than ordinary died; and ſuch as eſcaped, continued ill 14 days.

The greateſt inclination of the magnetic needle this month was 70°; the leaſt inclination 68° 10′. The greateſt declination 13° 40′; the leaſt, 13° 15′.

On the 28 of *April* at ½ an hour after 10 in the forenoon M. *Muſchenbroek* diſcover'd a very beautiful phenomenon, and which was ſeen till ¼ after 11.

In order diſtinctly to conceive this; ſuppoſe, the ſpectator P. (Fig. 6.) with his face to the ſouth, and his back to the north, and thus looking up to the heavens; then 2 circles with the interrupted part of another appear'd, whoſe planes were parallel to the horizon; Z the ſpectator's zenith, the centre of the greateſt circle F K H G, or rather of the ring, whoſe internal diameter was 58° 15′; its breadth could not well be defined, but it was judged to be more than 30′: He diſcover'd no colours in it, it appearing only white: The ſun S was in the centre of the 2d circle, which interſected the former in 2 places, K, H, and enter'd a little way into it: From the ſection H, there was a certain place G in the former white circle, brighter than the reſt, and of the ſame apparent magnitude with the ſun; in that part regarding the ſun it was variegated with different colours; the diſtance H G was 50° 30′, the internal diameter of the circle A B 45° 30′, this circle was tinged with a variety of colours, it was red internally, towards the ſun and white, externally, and the intermediate colours were a pale blue; they were exceedingly bright in the tract D for ſome little way: It was ſurprizing that this circle was not every where of the ſame breadth, but narroweſt at K D H: The breadth of this ring appear'd near twice leſs than the former; yet it was not meaſured with ſuch exactneſs as might be wiſh'd: This circle was touch'd by an arch of a 3d circle E lying very ſoutherly; which alſo ſeemed white, and deſtitute of all colour: This arch was the firſt that diſappear'd; then the eaſtern part A of the colour'd circle; and after that the ſouthern part E vaniſhed; and then alſo the eaſtern portion F of the white circle vaniſh'd; and after that the weſtern part B of the colour'd circle; upon which the weſtern portion G of the white circle diſappear'd, and at length its moſt northerly part.

The ſky was all the while overcaſt with ſmall clouds, interrupted here and there, as it were, and neither ſo denſe, nor quite ſo rare; and yet they ſeemed to be at a great height in the atmoſphere. Whilſt this phenomenon laſted, the wind was north-eaſt, and between the firſt and ſecond degree of ſtrength, and when the phenomenon vaniſh'd, it increas'd to the 2d degree, and continu'd ſo for an hour; afterwards it was more gentle again: This happen'd at the time of new-moon, the air being moderately warm; and tho' M. *Muſchenbroek* was very attentive in obſerving whether any icy or watery corpuſcles dropped down from the heavens, to which, as cauſes, the phenomena of circles might be aſcribed, as *Huygens*, *Maraldi*, and other learned men, had obſerv'd in parhelia; yet he could obſerve no ſuch thing: He the ſame day was told by credible perſons, that for the two preceeding days in the forenoon they had obſerv'd a ring about the ſun.

In this month the meaſles were obſerv'd, and tho' not frequent, of a kindly nature; ſo that no child, under his care died of them. About the middle of this month, the heat now relaxing the bodies, that were before conſtringed by the laſting winter cold, intermitting tertians broke out; which were all (as thoſe in the ſpring generally are) of a kindly nature; they increas'd with the firſt 3 paroxyſms, and then decreas'd, ceaſing for the moſt part in 6 paroxyſms, either ſpontaneouſly, or by uſing hot bitters, or ſome of the lixivious ſalts.

Double tertians, it is true were a little more obſtinate; but yet ſo eaſily cured, that they brought no ſmall credit to the profeſſion.

Here and there aged people were ſeized with *peripneumonia's*, which were mortal, and which yielded to no remedy.

The greateſt inclination of the magnetic needle this month was 71°, the leaſt 68° 45′: The greateſt declination 13° 35′, the leaſt, 13° 10′.

The beginning of *May* ſtill preſented nothing other than the diſagreeable and melancholy effects of a ſharp winter and laſting cold

cold: For, no tree had hitherto budded; only here and there the apricot and peach, expoſed much to the ſun in warm places, ſhelter'd from the wind, began, tho' very late, to unfold their bloſſoms: The limes that adorn the city walks, afforded ſtill a diſmal proſpect, without giving any ſigns of budding; and the fields ſtill continued to wear a no leſs melancholy aſpect: But after the 20 day the ſun ſo plentifully diſpenſed its heat over all the vegetable kingdom, that both leaves and bloſſoms broke out, and the ſpires of tender herbs ſeemed to haſten their growth to the eye: And this was the cauſe of a fruitful year; apricots and peaches were in great plenty, and afterwards ripen'd in their ſeaſon; there was alſo a plentiful harveſt, the ſummer and autumn being clear and warm, with moderate ſhowers of rain: It is an obſervation of ſome ſtanding in theſe parts, that a long, and not too ſharp a winter, and a backward ſpring, portend a fruitful year: For, generally in the beginning of *May* the nights are cold, and even froſty; which nip the tender embryo's of bloſſoms and fruit; wherefore if they are late a coming out, they afford a certain proſpect of fruit.

On the 4th of *May* at 10 o'clock in the evening the moon was ſurrounded with a corona, in which there was nothing uncommon, and neither ſtorm or wind enſued.

After the 25th, the *Lecca*, a mile and a half from *Utrecht*, overflow'd the Dykes near the *Wyck te Duerſtede*; below this town towards the ſea, the water ſtood 5 inches higher than the mark of imminent danger, ſet in ſome places of the dykes; this water came from the *Rhine*, after receiving the ſnow ſuddenly melted by the vernal heat: From the 16th to the 20th of *May* a prodigious quantity of ſnow fell about *Geneva*, which cover'd all the roads; a thing very uncommon in theſe parts at that ſeaſon; the melting of this ſnow ſwell'd the *Rhine* in that manner, and the *Rhine* the *Lecca*.

The month was uſhered in with mild pleuriſies, accompanied with the common ſymptoms only, and they went off pretty ſoon, by veniſection, cooling, diluent and moiſtening medicines: But a ſcarlet fever raged amongſt young children, which infected all that happened to be in the ſame houſe, or to frequent the ſame ſchool: on the firſt day they complain'd of a pain about the region of the heart, that ſtill afflicted them the 2 following days, with a great thirſt; hence the tongue was dry and cover'd with a white *mucus*; the fever in the mean time was continual and at the ſame pitch: About the end of of the 3d and beginning of the 4th day, the whole habit of the body was covered with ſmall flat puſtules ſo near one another, that ſcarce any intermediate ſpace was left: Hence the whole body was of a ſcarlet colour: Yet there were but few puſtules on the face; the eye-brows ſeem'd to have very ſmall punctures, and no bigger than the point of the fineſt needle; afterwards the tongue became very red; the firſt 4 days the patients had no ſleep, or at leaſt it was continually interrupted, with convulſions and a *delirium*: On the 5th day a drowſineſs came on, and the redneſs abated ſomewhat, the patients having a conſtant fruitleſs deſire of going to ſtool: The impetus of the fever decreaſed: The lips were dry and chapt, whereby the following days the fever was more decreas'd: Such recover'd on the 10th day, with a deſquammation of the whole skin of the body: But in other patients the fever increaſing on the 5th day caus'd *delirium*'s and convulſions, of which they died on the 8th day: This diſtemper was fatal to ſome.

The greateſt inclination of the magnetic needle was 70° 35'; the leaſt 69° 25': The greateſt declination, 3° 8'; the leaſt 12°.

In *June*, the 19, 21 and 22 days were very hot, there being none ſuch for the reſt of the year; for on thoſe days at noon the thermometer ſtood at 86, 90, 92°; yet ſome nights in this month were very cold, as the 9, 10, 11 and 12, on which it happened to freeze. This year the ſmall pox were very fatal. The diſtinct kind began this month very favourable, and without any thing uncommon; but they afterwards proved ſo much the more fatal. Towards the cloſe of the month, putrid fevers broke out, undoubtedly, owing to the great viciſſitudes of heat and cold; for, it happening to freeze the preceeding nights, the bodies of men were exceedingly relaxed by the great heat in the day time; hence aroſe acute fevers, which yet raged rather among the common people, who are more regardleſs of their health, than among the temperate citizens.

The greateſt inclination of the magnetic needle was 71° 15'; the leaſt 70° 25': The greateſt declination 13° 45'; and the leaſt 12° 17'.

In *July* there were few diſorders: Yet the ſmall pox ſtill continued, and gathered ſtrength, proving mortal in ſome inſtances: A young woman, in the prime of her age, labouring under the confluent kind, had ſuch an *impetus* of blood, that her *menſes* flow'd plentifully on the fourth day at an

unuſual

unusual time, with which she died on the sixth. This month was exceeding dry; and the air so dry that it quite parch'd up both plants and animals: Hence some instances of inflammatory *angina*'s, which would have prevailed more, had it not rained on the 27 and 28, whereby both vegetables and animals were refreshed.

The greatest inclination of the magnetic needle was 72°, and the least 71° 30′. The greatest declination 12° 55′, and the least 12° 28′.

In *August* there were frequent thunders, and a great deal of rain. The small pox seemed to grow somewhat milder; many, it is true, had them, but generally of the distinct kind; the patients were scarcely sick, and requir'd no medicines; and thus they were happily cured.

Intermitting tertians began to appear, as is common in *August*, but as favourable as in the spring, and were happily removed, either with bitter antifebriles, lixivious salts, or sal ammoniac, seldom exceeding the sixth paroxysm.

The greatest inclination of the magnetic needle was 72° 3′, and the least 71°: The greatest declination 13° 36′, and the least 12° 25′.

On *Sept.* 26, between 5 and 6 in the evening, a large *corona* was observ'd about the sun; but as M. *Muschenbroek* himself did not see it, and as little credit is to be given the accounts of the unlearned, he waves the description of it.

In the mean time intermitting tertians prevailed, which were more malignant than the former; so that for the first three or four days, after the manner of autumnal fevers, they emulated the continual: When the first ferment was over, they shew'd themselves either simple or double tertians, which required stronger remedies than the fevers in *August*; and they yielding either to vomits and the salts, or to the bark. There likewise arose burning and acute fevers, greatly endangering the patients, carrying off most, and sparing none, unless forcibly snatched from the jaws of death: A girl, of about six years of age, had such a burning fever upon her, that the third day from the onset, she was not only delirious, but discharged a great deal of blood at the mouth, nose, *anus* and *pudenda*; and within the fourth day she died miserably convulsed.

Now the small pox had acquired strength, and were generally of the confluent kind; on the eighth or ninth day they proved mortal to many, and made terrible havock both among children

children and adults: Yet hitherto they had not arrived to the highest pitch of malignity, as in the following months.

The greatest inclination of the magnetic needle was 72° 30′; the least 71° 45′: The greatest declination was 13° 40′; and the least 13° 11′.

For the whole month of *October*, *angina*'s prevailed, rather watery and mucous than inflammatory, as being accompanied with a slight, or scarce any fever at all, the almonds of the ear were chiefly swell'd, the *uvula* also fallen down; but easily cur'd by strong cathartics, and a heating plaister put round the *fauces*.

There were some instances of dysenteries, noways mortal, but happily cured by a dose of *hypecacuanha*.

Simple or double tertians were neither rife nor obstinate, generally terminating in seven periods, and yielding to gentle medicines.

Towards the close of *October*, namely after the 26th, coryza's were frequent in a great part of the city, with a fever from an extraordinary inflammation of the *membrana schneideriana*, generally ascribed to the cold of the 26th at night, when there was a remarkable frost.

But the small pox, which were the principal distemper this month, were the confluent kind, malignant, mortal and very small: They made great havock in the city: And such as escaped, had their faces ever after much disfigur'd.

On the 21st in the evening M. *Muschenbroek* observ'd a small *aurora borealis*, in which there was nothing uncommon: In the very north point, from an arch'd cloud, elevated a little above the horizon, arose, as is usual, bright columns, neither rising high, nor very shining: The whole phenomenon ceas'd in an hour, and began at ¾ after 7 in the evening. By the news-papers, it appear'd that on the same day an *aurora borealis* was observ'd in *Italy*.

The greatest inclination of the magnetic needle was 72° 30′; the least 70° 45′: The greatest declination 13° 48′; the least 13° 20′.

Nov. 16. a very bright *aurora borealis* appear'd, and such as M. *Muschenbroek* never observ'd any like it, either as to size, brightness, or the surprising mimickry of its different appearances: It was very large, and observ'd in several cities of *Holland*; at *Leyden* by M. *Zumbachius*, and at *Rotterdam* by an anonymous person, who describ'd it in the literary journals for this year; the former explaining it in

Differ-diſſertation expreſs: It was likewiſe obſerv'd at *Berlin* by M. *Kirch*, and inſerted among his aſtronomical obſervations. M. *Muſchenbroek* diſcover'd it at about 8 in the evening; at that time it poſſeſs'd the north, eaſt and ſouth parts of the heavens, the weſt alone being free from it. The ſky was ſerene, but a white and opaque cloud, 15 degrees above the horizon, began from the north, extending from thence beyond the eaſt, but terminating by an oblique edge in the horizon; ſo that between eaſt and ſouth, it deſcended below the horizon. This cloud darted forth white, ſhining, but not very bright rods, ſome of which were carried direct, and others oblique to the zenith: Sometimes ſuch as aſcended from different parts, met together there, and then whirled about with a vortical motion, went off to the ſouth, weſt, or ſome other intermediate point, falling down, as it were, towards the horizon; a thing often obſerved by others in *auroræ boreales*: But now in the eaſt a huge, threatning, fiery erect column ſtood perpendicular to the horizon, which ſeemed ſix degrees broad, and 45 degrees high: This huge body was not ſo fleeting as the ſlighter radiations, for the moſt part of a very ſhort duration, but for ſeveral minutes continued without changing either its figure or magnitude; yet it was carried with a ſlow motion towards the ſouth, and in a quarter of an hour it vaniſh'd. At the ſame time in the ſouth, about 24 degrees high, were two ſhining columns, parallel to the horizon, large, broad, and extending in length, one extremity of which regarded the eaſt, the other the weſt: They were ſeen in this manner for three minutes, then they approach'd ſlowly to each other, and were both blended together, and in two minutes after entirely vaniſh'd, without leaving any trace behind, and the ſky there remained ſerene: But very beautiful phenomena were ſeen at half an hour after nine; for, a very broad column roſe perpendicularly above the horizon, in that part of the heavens, 20 degrees from the north towards the eaſt; this was red as glowing hot iron, denſer than the other whitiſh rods; for, ſcarce could a ſtar of the firſt magnitude be ſeen thro' it: This was ſeveral times renew'd; ſhone for five or ſix minutes, and becauſe a new one roſe up continually, it laſted for upwards of an hour: At the ſame time there aroſe from the north towards the zenith a rod of very white light, that blazed much; it was very bright where it adher'd to the cloud, and darker the higher it aſcended; its breadth was much leſs than that of

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the former: It mov'd ſlowly from the north along the eaſt to the ſouth, parallel to itſelf. At 10 o'clock the ſky all around was on a blaze, and the four quarters of the heavens ſtrove, as it were, which ſhould outſhine each other in brightneſs; for, now that part of the heavens, between north and weſt, which hitherto had been quiet, emitted at different times a great number of very bright rays, that were carried partly towards the zenith, and partly in an oblique ſituation to the horizon from north to weſt: In a moment after, a north-eaſt wind ariſing, there was a very beautiful appearance, and ſuch as M. *Muſchenbroek* never obſerv'd either before or after: Hitherto the matter of the *aurora borealis* remain'd unmov'd above that tract of the atmoſphere, where the wind blew; but the wind aſcending a little, graz'd gently along its lower part, and carrying off portions of it here and there, made the heavens ſhine with interrupted coruſcations, that mov'd very ſwiftly, like undulating waves: He obſerv'd this for upwards of an hour in the eaſt, not that its appearance was conſtant; at one time it was ſeen, and again it was quiet for two or three minutes, and was ſoon renewed again; ſo that it ſhone by fits. M. *Muſchenbroek* wiſhed he could have mark'd all the phenomena that appear'd at the ſame time; but they were ſo numerous that 1000 eyes were not ſufficient for the taſk; and when he directed his eyes to one part, a thouſand things worthy obſervation eſcap'd him in the oppoſite part behind. After 10 o'clock there aroſe in the weſt as far as the north a ſeries of three black clouds, at different heights above one another; the loweſt was arch'd, with its legs inclined towards the horizon; the other two, diſtinct from each other, were defined by ſtreight ends parallel to the horizon; from theſe were emitted ſhort rays, that ſcarce ſhone, like the teeth of a comb, as it were; in ſome places brighter and much longer, like a bright ſmoke tumbling out of a chimney. At 11 hours the heavens ſtill ſhone from all quarters, eſpecially the ſouth; not that the columns aroſe from the ſouth towards the zenith, but they were depreſs'd from the zenith towards the horizon, being driven by a northerly wind from the north along the zenith towards the ſouth: By this time the wind had increas'd to the ſecond degree of ſtrength, whereby the appearances ſeem'd to diminiſh ſlowly; the columns were not ſo frequent, of a ſhorter duration, and ſooner roll'd along till at 12 o'clock the ſky began to be overcaſt; in a little time after it clear'd

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up again, but with a much leſs brightneſs than before: At length at 2 o'clock in the morning the whole ceas'd, there ſtill remaining ſome denſe clouds, and ſome white ones, that ſtood unmoved in the weſt, north and eaſt, at about 45 degrees above the horizon, the reſt of the heavens continuing ſerene: Whilſt this appearance laſted, the ſky was ſo clear, that M. *Muſchenbroek* could diſtinguiſh the larger characters almoſt as eaſily as in a clear night, when the moon ſhines, and is not at the full: When the whole heavens were on a blaze, there was then no ſhadow projected from the houſes: This *lumen boreale* happened after a ſoutherly wind, that blew hard the night before.

In this month M. *Muſchenbroek* obſerv'd ſome rheumatiſms, which, accompanied with the common ſymptoms, ſometimes yielded to medicines; yet at other times they carried off the patients, by throwing the morbific matter either into the brain or inteſtines: There was likewiſe a pleuriſy, but of a kindly nature, and eaſily removed by repeated veniſection, and cooling, diluent medicines: But M. *Muſchenbroek* with horror reflects on the ſmall pox, which were ſo peſtilential and malignant, that, probably they never were more ſo, ſcarce a houſe in *Utrecht* eſcap'd them: In *November* there commonly died 20, or at moſt 25 every week; but what havock did the ſmall pox make at this time? In the firſt week were reckoned 65, the ſecond 74, the third 69, and the fourth 59. When the plague raged moſt in *Utrecht*, according to the accounts from hiſtory, there did not die ſo many in a week. The ſmall pox carried off ſome on the fourth or fifth day from the firſt onſet; others on the 8th, 11th, 14th, 16th; nay, a month after, namely, when the patients bodies became corrupted with the infection. And ſuch as eſcap'd were in the greateſt danger; and ſometimes ſuch, as had the favourable ſort, and with the beſt ſigns, died ſuddenly; and others recover'd, who had had the worſt ſymptoms, and ſeemed to be infected with a gangrene: At this time no one could aſcertain the life of any patient, as the diſtemper continually eluded the moſt ſkillful in the profeſſion: Sometimes, it is true, there were great hopes, but there was no certain prognoſtic. M. *Muſchenbroek* himſelf ſaw and had under his care ſome patients, on whom the ſmall pox had broke out again after the 14th day, in pretty great numbers on the face and the reſt of the body, and which ſuppurated only on the 22d day, yet ſuch recover'd:

He has often seen the tongue, palate, and gums so full o the small pox, that one could not find a place the breadth of a mustard-seed free of them: But all such patients died: He observ'd them for several days make white stools very full of *pus*; so that the whole intestinal tube was no other than the repository, as it were, of the small pox, and the *ductus coledochus* itself was beset and blocked up with them; some of these died, and others recover'd: M. *Muschenbroek* compiled very accurate histories of a great many of these patients, that he might learn the surprising nature of this distemper; but they are too prolix, to be inserted in these journals: He wishes some one were so lucky as to find out a specific for this contagion: After M. *Muschenbroek* had tried several things, he found that such patients were the luckiest, who were left to themselves without any medicines: Hence such physicians as prescrib'd nothing sav'd the most patients: Some kill'd their patients by officiously giving them an infusion of sheep's dung, and others were not more succesful with their acid spirits, as spirit of nitre or oil of vitriol in their ptisans, &c. Hot medicines and sudorifics were as prejudicial, as diluent and cooling ones: Venisection on the first days before the eruption of the pustules was almost infallibly mortal: M. *Muschenbroek* is both asham'd and griev'd to say any more on this distemper, the great reproach of the profession.

The greatest inclination of the magnetic needle was 72 degrees, the least 70° 35′: The greatest declination was 13° 28′; the least 13°.

The month of *December* was exceeding rainy; and in the four years M. *Muschenbroek* carefully made such observations, he does not remember that a greater quantity of rain fell, it being four inches and a half. On the sixth day the mercury in the barometer was lower than ever it had been in the whole four years, being at 27 inches 10 lines.

The small pox still raged as in the former month; yet they were less mortal, because the number of subjects on which they might exert themselves was fewer. About the middle of *December* some tertians arose, but exquisitely favourable; as was also a pleurisy, that carried off a few, and accompanied with the usual symptoms,

The greatest inclination of the magnetic needle this month was 72° 48′; the least 71° 10′. The greatest declination was 13° 21′, and the least 13° 13′.

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The whole quantity of rain that fell this year was 25 *Rhinland* inches 1 line and ¼ perpendicular height: The quantity of water, that evaporated out of the open veſſel above deſcrib'd, was equal to 32 *Rhinland* inches 2 lines and ¾. Should any one aſk, if a greater quantity of water evaporate than falls down, what becomes of it? In anſwer, let him conſider, that the quantity obſerv'd by M. *Muſchenbroek* aſcends from the water, and not from the earth, upon which notwithſtanding the rain falls; conſequently, if the quantity of rain, that falls in theſe parts, had likewiſe its origin therefrom, and the ſuperficies of the earth were as large as that of the water, a twice greater quantity of water nearly muſt neceſſarily aſcend in the form of vapours, than what ſeems to fall down in the form of rain. That a greater quantity of water evaporates than what falls in rain is the caſe not only in theſe parts; but M. *De la Hire* obſerv'd the ſame thing in *France*, as may be ſeen in the *Memoirs of the Royal Academy* at *Paris* for 1703.

Whoever ſurveys the magnetical obſervations, cannot but be ſurpriſed at the viciſſitudes of inclination and declination, to which magnetic needles are daily ſubject in the ſame part of the earth: Hence it is impoſſible for one from the known declination of the needle for ſome time before, to conclude that he is in the ſame place, when he obſerves the ſame declination: For, the variations are very irregular: They by no means agreeing with the changes of the atmoſphere, either as to its degree of heat, weight or motion: Wherefore, the cauſe, which directs the magnet in the boſom of the earth, is not to be ſought for above itſelf; this will neceſſarily be ſubject to perpetual motions, and theſe do ſteel needles obey on the ſurface of the earth. Upon examining his obſervations for the whole year, M. *Muſchenbroek* doubted, whether it ſhall ever be poſſible to promote the doctrine of the magnet ſo far as to be able to bring its declinations to certain rules, and to predict them at ſtated times for any part of the earth: Nevertheleſs it will neither be unprofitable nor unpleaſant to collect ſuch obſervations; becauſe they may at ſome time or other happen to ſhew more of the cauſe, than we could have expected.

Concerning the Difficulty of curing Fluxes; *by Dr.* Cockburn, Phil. Transf. N°. 425. p. 385.

IN reading Dr. *de Juſſieu*'s memoir, about the preſent diſgrace of *ipecacuanha* in *France*, and the method he propoſes for redreſſing its defects by *Simarouba*, a root brought from *Cayen* in *America*, Dr. *Cockburn* was ſurprized to find a remedy, almoſt adored for half a century, to have fallen into the utmoſt contempt; a ſpecifie, (a very ſhort and ſatisfactory word) entirely neglected by its moſt zealous votaries. The learned profeſſor alledges, that this great revolution in the fame of *ipecacuanha*, is owing to its having been unskilfully adminiſter'd: Phyſicians commonly conſidering the general appearance of a looſeneſs only, without penetrating into the particular cauſes which ſupport it, and require on that account different methods of curing it. M. *de Juſſieu*, avoiding all extremes, is not for baniſhing *ipecacuanha* altogether out of the practice of phyſic, as many of its diſappointed adorers now do; becauſe it is not the infallible ſpecifie they vainly imagined it to be.

This common miſapplication of medicines, or our ignorance of the particular circumſtances of a diſeaſe, when it requires a different method of cure, is the very reaſon why great numbers of excellent medicines among ancient phyſicians have been loſt; becauſe they were not underſtood. Take a broken ſhin, for inſtance, which has the skin only rubbed off, obſerve the difficulty the beſt and honeſteſt ſurgeons have to cure it: Go to *Aetius* and others, where you may find a ſafe, eaſy and ſpeedy cure, which as the ſame author on another occaſion obſerves, the people make ſlight of; becauſe they do not know the danger or trouble that often attend it.

A looſeneſs is more liable to be miſtaken than the greateſt number of other diſeaſes; becauſe it is produced by 2 immediate cauſes that are very different, when the reſt have one cauſe only, however great the diverſity of particular caſes may appear to be. A fever, for inſtance, has but one cauſe, tho the variety of fevers, or the various appearances of a fever are infinite, and never can be claſs'd by obſervation: The Dr. therefore, conſiders the different circumſtances of a looſeneſs obſerv'd by Dr. *de Juſſieu*, and that occaſion the miſapplication of *ipecacuanha*: But the former afterwards endeavours to make the latter's account more perfect; for, thereby phyſicians will be able to have more perfect intentions and views of curing than hitherto they have had.

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'When great crudities, *says Dr.* de Juſſieu, and indigeſted 'ſtuff in the firſt paſſages, or an obſtruction in the *viſcera* 'of the lower belly, are the cauſe of a looſeneſs, we may 'always expect the common good effects of *ipecacuanha* 'for a cure. On the contrary, when *ipecacuanha* is given 'againſt an hepatic dyſentery, or againſt a great diſcharge 'of blood upwards or downwards, often occaſion'd by a purging 'medicine that was given for a cure of the looſeneſs, no ſuc-'ceſs can reaſonably be expected from the ſpecific; far leſs 'have we any hopes, when *ipecacuanha* is given for the cure 'of a looſeneſs that ſubſiſts on an inflammation of the lower 'belly, or when ſharp and fixed pains give us a ſuſpicion 'that the dyſentery has a cancerous ulcer for its cauſe.

As there is no difficulty that is peculiar to a dyſentery, and is not common with the dangers of a *diarhœa*, the terror of blood not excepted, it muſt be acknowledged that any vomit as well as *ipecacuanha* is a proper cure againſt ill digeſtions and crudities in the ſtomach, as *Hippocrates* anciently obſerv'd; and has been believ'd by all phyſicians ſince his time: ſo that there is nothing in the *French* ſpecific that is not in ſalt of vitriol; which we find held its reputation in curing dyſenteries longer than *ipecacuanha* is like to do.

It is more ſurpriſing, that this way of curing a looſeneſs by *ipecacuanha* was not ſooner determined. Nothing beſides the idle talk of a ſpecific, that excludes all reaſoning and reflection, could have made men eaſy under ſuch groſs ignorance. The very inſtance given us by the late excellent Dr. *Tournefort*, in the caſe of his tutor *Petrus Sylvanus*, is a ſufficient proof, that *ipecacuanha* is no charm of a ſpecific; but that it cures by its evacuating: For, when the weakneſs of *Sylvanus* made them cautious in adminiſtering the ſpecific, the diſeaſe held its ground againſt the charm, and its adorers; till deſpair drove the phyſician upon larger doſes, the laſt reſort of the vanquiſh'd; and they produced evacuations by vomit and ſtool, and thereby his health in one night.

It would be ſuperfluous to obſerve any thing on what is ſaid about the *Simarouba*, and how far it may remedy the defects of *ipecacuanha*; the trials of it being few, and not ſufficient to determine the univerſality of its uſe: Far leſs does the Dr. enquire, whether the *Weſt-India* plant has any relation to the *Macir* from the *Eaſt-Indies*, mention'd by *Pliny Hiſt. Nat. lib.* 12. tho' he wiſhes Dr. *de Juſſieu*, had prepared the *Simarouba*

marouba with honey; since the great cures (recorded by *Pliny*) performed by the *Macir*, might be assisted by its being prepar'd in that way. The Dr. then proceeds and makes the foregoing account more perfect, more obvious, and better fitted to fix the views of physicians in the point they are to pursue: For this purpose he gives a plain account of the several species of a looseness, and in each of them he applies the different kind of remedies made use of for their cure. Thus we shall perceive the proper administration for every looseness, and how far any of them is left without a cure.

The anatomy of the guts alone informs us, that the immediate cause of every looseness, whether symptomatic or essential, must either be a quicker conveyance of the common quantity of concocted food, and of the liquors that are commonly mix'd with it in the guts: Or the cause of a looseness is a greater secretion than ordinary of a watery substance from the blood into the guts, and brought into them by the pancreas, and various other glands. In both which cases there must needs be a larger discharge of liquid excrements by stool than usual, or there must be a looseness. A looseness, produced by the first of these causes, admits of great variety; both on account of the different *stimuli*, and even the different degrees of the *stimulus* in each of them. The *stimulus*, for instance, of indigested food, fruits and the like, differs very much from that of gall. The first sort is confined to the stomach and intestines; in which case the disease is often a cure to itself: Whereas the *stimulus* of gall is greater, and the cause is more permanent, and seldom carries off itself. The degree of the *stimulus* may be determin'd by some other concomitant symptoms of slime, glair, &c. But when the *stimulus* is occasion'd by the piles, an ulcer, or a stricture in the guts, it is vastly more violent, and departs from the common cure of a looseness; whereby physicians are often subject to fatal errors, and gross misapplications of their medicines. The watery looseness, produced by the other immediate cause, is, indeed, deplorable; because a method of curing it, is not commonly known. It is not only as a principal, but it is a second in the beginning, at the end and in the intermediate times of all other diseases, and even in old age, when nature is submitting to the power of death; when physicians call it a colliquative looseness; because it seems to melt away the flesh of the patients. *Petrus Salius Diversus*, a most approv'd physician, affirms in *lib. de peste p.* 188, 189, that it is vain for a physician to attempt the cure of of it. *Carolus Piſo*, who endeavours to explain it; and the moſt ſagacious *Laz. Riverius*, after trying all the common methods, give us no better hopes of a cure.

It is now manifeſt, why a looſeneſs, that in all outward appearance is one and the ſame thing, and promiſes to yield to the ſame remedy, is vaſtly different in the manner of curing it. Our experience has contradicted our belief; and the remedy that has prov'd effectual and ſufficient in one caſe, has prov'd ineffectual and uſeleſs on other occaſions; on which account remedies are very liable to be miſapplied.

To prevent this misfortune, in a great meaſure, for the future, Dr. *Cockburn* conſiders the medicines commonly made uſe of by phyſicians for the cure of a looſeneſs; and how they may moſt properly be adapted to that end: For, thus we muſt perceive the particular caſes wherein they are like to be uſeful, and when they are not like to be of any uſe at all. Aſtringents, or binding medicines, were the firſt employ'd for the cure of a looſeneſs, as well as of every other evacuation: But *Hippocrates* obſerving that a looſeneſs was often the eaſieſt cured, when it was attended with vomiting, vomiting medicines were introduced on that account. On a like conſideration, purging medicines were admitted by *Celſus*; becauſe he found the purging the cure of itſelf; or that the looſeneſs went off by going to ſtool for a few days: But he adviſes phyſicians to take care that the looſeneſs does not run longer than 7 days, and that it is not attended with a fever: For, in that caſe the looſeneſs is not critical and ſalutary, but ſymptomatical, and haſtens on the ruin of the patient. All theſe obſervations have not been found univerſally true in many other countries: For, *Cælius Aurelianus*, a moſt accurate obſerver of diſeaſes, *Rhazes* and *Avicenna*, blame this free uſe of purging and vomiting, and this may be juſtified by what ſhall be ſhewn anon. But now that we may apply this artillery of phyſicians againſt the 2 general cauſes of all looſeneſſes, the Dr. begins with the moſt ancient of the mention'd methods, which was practis'd by *Prodicus Selymbrianus*, whoſe ſchool was adorned by the divine *Hippocrates*. Binding medicines, as the Dr. obſerv'd, were employ'd for the cure of every evacuation, and are ſtill the refuge of phyſicians, when all other methods have been baffled, under their own conduct and direction; they tacitly have the preference given to all other medicines: *Ipecacuanha*, for inſtance, is preferr'd to any other vomit, and rhubarb to any other purge; becauſe they are more aſtringent than any other

other of the tribe. So far do physicians extol the power of astringents, that many of them affirm, that any looseness may be repress'd by them, if they did not think it unseasonable or improper. However it may stand with these boasters, it is very certain, that these medicines only affect a looseness occasion'd by a *stimulus*; and if this be small, the looseness may be cur'd by it: But if the degree of the *stimulus* be greater, the astringent medicine is either not able to put a stop to it, or it will tear the patients with gripes if it do. It is on the same account of a *stimulus*, that a vomit or a purge is properly premis'd to other medicines, if it consist with the strength of the patient: But after all, the storehouse of physicians seems to be exhausted in curing a looseness that proceeds from indigestion, or gall: But if the *stimulus* be from the piles, an ulcer, or a stricture in the guts, physicians are at a loss for want of a remedy, and too frequently have recourse to the omnipotent astringent, without any success. Here is a real want, an inability and unskilfullness in our work, and leaves too much room for misapplying medicines. But if we turn these engines of vomiting, purging and binding, upon the other general cause of a looseness, they either fall very short, or like a little water thrown upon a large fire, they rather inflame than extinguish it. *Hippocrates*, it is true, does not mention the watery looseness *Coac. Prænot.* 134. *prædict.* 81. but he says many things that peculiarly concern it; which *Foësius* not understanding blamed him for obscurity in this place. *Piso Sect.* 4. *cap.* 1. *Obs.* 54. gives a very plain description of this looseness, and his observation is admitted by every succeeding Physician. The desperate state of the watery looseness was formerly mention'd from the confession of authors of the greatest knowledge and veracity; and physicians shall for ever find that looseness to become more violent the more they press it with astringents, vomits, or purging medicines. The boasted omnipotency of putting a stop to a looseness at pleasure must serve another use with the patient; tho' it may not be able to put the desir'd stop to his purging. There is even a singularity in the cure of this looseness, which the Dr. thinks has not hitherto been observ'd. In every other kind of looseness the stools acquire a consistence, when they begin to be cured; but in the watery looseness, the stools commonly lessen in quantity, tho' not in their looseness. The Dr. would say something of *opium*, a medicine often made use of for the cure of every kind of looseness, but as it neither acts as an astringent, nor in a way obſerv'd by phyſicians, it muſt ſtill remain among other *deſiderata*.

An Account of a Comet *ſeen* Feb. 29, 1731-2; *by Mr.* Dove. Phil. Tranſ. N° 425. p. 393.

THE 29. of *February*, at about ½ an hour paſt 10 at night, as Mr. *Dove* judges (having had a good obſervation at noon) they were in Lat. 34° 28′ ſouth, and Long. 12° 35′ W. from Cape *Bonne Eſperance*, the moon ſhining very bright, being near the full, they obſerved ſomething very bright riſe about the weſt, paſſing from weſt to eaſt in about five minutes between the moon and their zenith, and to the ſouthward of *ſpica virginis*; it carried a ſtream of light after it about 40° long, and 1° or 1° and ½ broad: The brightneſs of the moon outſhone the comet as it came near her.

Two Experiments of the Frictions of Pullies; *by Dr.* Deſaguliers. Phil. Tranſ. N° 425. p. 394.

THE firſt experiment was made with a tackle of five braſs-ſheevers in iron frames or blocks; that is, three ſheevers in the upper block, and two in the lower.

Having made an *equilibrium* by hanging one hundred and a quarter at the lower block; and a quarter of an hundred at the running rope; he added 17 pounds and a half before the power could go down and raiſe the weight.

Exp. 2. Two hundred and a half being balanced by half a hundred, the addition of 28 pounds made the power raiſe the weight.

N. B. The ſheevers were five inches in diameter, the pins half an inch, and the ropes three quarters.

In the firſt experiment 17 pounds and a half exceed by four pounds and a half the ſum of the frictions deduced from the theory: But in the ſecond experiment 28 pounds exceed the ſum of the frictions but one pound.

The reaſon of this appeared to be, that the rope at firſt was too big for the cheeks that held the ſheevers: But in the ſecond experiment, where the rope was more ſtretch'd, it was ſomewhat diminiſh'd in diameter; and conſequently brought off from rubbing ſo hard againſt thoſe cheeks.

From knowing the quantity of friction *à priori* in ſuch large tackles, we may know what to expect in practice: For, if one man, who for a ſmall time can exert the force of one hundred

hundred pounds, thinks that he may draw up a ſtone, or a roll of ſheet-lead, or any other ſuch weight to the top of a houſe with a tackle of five (becauſe this would ſeem feaſible from mechanical principles) will find himſelf miſtaken on account of the friction, which will not be ſurmounted without an additional force of 50 pounds.

Farther Experiments concerning Electricity; *by Mr.* Stephen Gray. Phil. Tranſ. N° 426. p. 397.

ABOUT the latter end of *Auguſt* 1732 (Mr. *Gray* being at Mr. *Wheeler*'s) after having repeated the experiment of making ſulphur attract leaf-braſs *in vacuo* (Mr. *Wheeler* having a very good air-pump of the larger ſort, made by Mr. *Hauksbee*) they ſuſpended from the top of a receiver, which was firſt exhauſted, a white thread that hung down to about the middle of the ſame: Then the receiver being well rubbed, the thread was vigorouſly attracted by it: when it was at reſt and hung perpendicular, the tube was rubbed, and being held near the receiver, the thread was attracted towards that ſide of it: If the tube were removed ſlowly, the thread returned to the centre of the receiver; but when mov'd ſwiftly, the thread was attracted by the oppoſite ſide of the receiver: If the hand were held near the receiver, and mov'd haſtily from it, the thread was attracted by the oppoſite ſide, as before. This ſeemed at firſt difficult to be accounted for; but upon farther conſideration they concluded it proceeded from the motion of the air made by the tube; and in the other caſe by that of the hand, which took off the attraction from that ſide, and not on the other ſide: So that as Mr. *Wheeler* very well expreſſed it, by this means the balance of the attraction was taken off.

They made another experiment by ſuſpending a thread on the top of a ſmall receiver, and whelming a large one over it: Then by firſt rubbing this, and holding the rubbed tube near it, the thread in the middle receiver was attracted to that ſide of it where the tube was held.

An experiment ſhewing that attraction is communicated thro' opaque as well as tranſparent bodies, not *in vacuo.*

There was taken a large hand-bell, the clapper being firſt taken out, and a cork ſuſpended by a thread from the top of the bell, the cork being ſmear'd over with honey: Then the bell was ſet on a piece of coach-glaſs, which had been well rubbed, on which the leaf-braſs was laid: Then the tube being

ing rubbed, and held near the handle of the bell, and afterwards near the top and ſide of the ſame, the bell being taken off, there were ſeveral pieces of the leaf-braſs ſticking to the honey'd cork, that had been attracted thereby: It likewiſe appear'd that ſome others of them had been attracted by the bell, being removed from the places they were left in, when covered by it.

Some time after Mr. *Wheeler* told Mr. *Gray* of an experiment he had made *in vacuo*, when the latter was gone from him. He took a ſmall receiver and in it he ſuſpended a thread, and over this four other receivers all exhauſted, and the thread was attracted thro' all the five receivers, and he thought the attraction was rather ſtronger than before, when a ſingle receiver only was made uſe of: But inſtead of wet leather, he made uſe of a cement Mr. *Gray* had recommended to him, *viz.* bees-wax and turpentine, which was what Mr. *Boyle* made uſe of in his experiments with the air-pump, and that, as Mr. *Gray* told Mr. *Wheeler*, it was his opinion the attractions would be much ſtronger, the ſteams of the wet leather taking off ſome of the attracting force.

Mr. *Gray* proceeds to give ſome account of the experiments made at Mr. *Godfrey*'s; the firſt of which was giving an attraction by the tube to a boy ſuſpended on hair-lines, and that by the intervention of a line of communication, the attractive virtue paſſes to another boy that ſtands ſeveral feet diſtant from him. But before he go any farther, he gives an account of that experiment of the attractive power that is communicated to the boy ſtanding on roſin.

June 16. 1731, in the morning, Mr. *Gray* took two pieces of white roſin made into round flat cakes of ſomewhat more than eight inches diameter, and two inches thick. Theſe were laid down on the floor of his chamber ſo near each other, that the boy might ſtand with one foot upon one cake, and with the other upon the other cake of roſin: Then the leaf-braſs being laid under his hands, the tube rubbed and held near his legs, caus'd both his hands to attract and repel the leaf-braſs to the height of ſeveral inches: Or if there was laid leaf braſs under one hand, and the tube held near the other, there was an attraction communicated to the farther hand; and when the tube was applied either to his hands or feet, there was an attraction communicated to his cloaths: So that a piece of white thread being held by one end, the other end would be attracted at near the diſtance of a foot: So

that

that the attraction is altogether as strong, if not stronger than when the boy was suspended on hair-lines.

Now as to the first experiment at Mr. *Godfrey*'s: One of the boys being suspended on the hair lines, and the other standing upon the two cakes of rosin, the boys holding hands with each other, under the boys hand that stood on the rosin was laid the leaf-brass; then the tube being rubbed, and held near the boy's feet that hung on the hair-lines, the hand of the boy that stood on the rosin attracted strongly. Then there was taken a four foot rule and given the boys to hold by each end; and there was the same virtue of attraction communicated to the other boy as before. After this a line of packthread was given them to take hold of by the ends; and there was an attraction communicated from the one end to the other, with as much vigour as by any of the other methods before-mentioned. This experiment was made *Sept.* 13, 1732.

Sept. 14. Mr. *Gray* first made the following experiment: There was taken a rod, compos'd partly of wood and partly of cane: It was 24 foot in length, and in form not unlike two fishing rods supposed joined together at their bigger ends. This rod was suspended horizontal by two threads of silk: Over this about two foot from the ends was suspended a small hazel wand, about five foot long, at right angles to it, but not touching the rod: Then going to the other end of the rod, the tube being excited and held near it, repeating the same three or four times as usual, and going to the hazel wand with a small white thread, he found that it attracted when held near any part thereof. The next day by Mr. *Wheeler*'s and Mr. *Godfrey*'s assistance he repeated the experiment; and they found that by suspending the wand at several heights, there was an attraction, when it was at the height of more than 12 inches. He now gives some account of his repeating, and what farther improvements he made to some of the experiments since his return to *London*.

Sept. 29. He repeated the experiment on two boys; first setting one of them on cakes of rosin, and the other being suspended on the hair-lines, and the effect was the same as has been above related. He then caused both the boys to stand on cakes of rosin, giving them to hold a piece of a *Spanish* cane fishing rod that was 8 foot long; the one boy holding one end, and the other the other end of the rod; then the leaf-brass being laid on the stand, and one of the boys holding

holding his hand over it; Mr. *Gray* went to the other boy, and the excited tube being held near the palm of his hand; the first boy's hand attracted and repelled the leaf-brass strongly. Then there was a piece of packthread given them to hold by each end, about the same length with the rod, *viz.* eight foot long. Under each of their hands was laid leaf-brass; then going to the middle of the line, holding the tube near it, the farther hand of both the boys attracted the leaf-brass with so much vigour, that it is not to be doubted that had the line been much longer, they would have attracted at a far greater distance. He then caused the boys to stand on the cakes of rosin; so as to let the flaps of their coats touch; and then by holding the tube to one of their hands, the other hand attracted, but not with more force than when they were distant the length of the line: Then they stood so much farther as not to let their coats touch by about an inch; and then exciting one of them to attract, the other did not receive the least degree of attraction: He then bid one boy put his finger upon the other boy's wrist, whereupon he immediately became electrical.

Oct. 4. He made the following experiment: A fishing rod, of about 10 foot 8 inches long, being horizontal; and over it towards the lesser end, a small rod (being the top end of another fishing rod) at the lesser end, which was whale bone, there was put on a ball of cork two inches diameter, the small rod touching the large one; then the tube being excited, and held near the great end of the large rod, applying it as usual: Then going to the cork with a pendulous thread, he found it attracted it at the distance of at least two inches. Then the rod was moved higher (so as not to touch the end of the long rod) about an inch by estimation; and after several trials there was a visible attraction, when the little rod, that carried the ball, was 34 inches above the large one.

Oct. 5. He took a line of packthread 17 foot 4 inches long, with silk lines tied to the ends of the packthread; one of them about 4, the other 2 foot long, near 2 of the opposite corners of his chamber, where in each of them was driven a hook at about 3 foot and ½ high, to which the ends of the silk were fastened, drawn so tight as to bear the packthread nearly horizontal: Then the small part of the fishing rod was suspended over the packthread at about 4 foot from the end; then the tube being applied to the other end of the packthread, the cork ball at the end of the little rod was attractive, and at several

ral removes, to the height of 47 inches, there was a visible attraction of the pendulous thread.

Oct. 6. Instead of the small rod he took a packthread about 4 foot long, and having tied silk threads to each end, by which the thread was suspended over the longer line horizontally, and at right angles nearly to the said line, which was by tying the ends to perpendicular lines of packthread, that were fastened to hooks at each end, and had sliding knots of them; so that the cross line might be mov'd higher or lower, as there was occasion for it: Upon one end of this line he put a ball of cork, and found, that when the first line had been excited, the virtue was carried up to the second line, and caus'd the cork ball to attract: He then took off the cork ball, and put one of ivory in its place; and this attracted after the same manner: Afterwards he hung two ivory balls, one at each end of the line, and found there was a sensible attraction, when the line that supported them was raised 38 inches above the line of communication.

Oct. 30. He repeated this experiment; and now when the line that supports the ivory balls was elevated about an inch above the communicating line, either ball attracted the thread at the distance of more than a semi-diameter of the ball; and at the height of 10 inches, at least half the same distance.

By these experiments we find, that the electric virtue may not only be carried from the tube by a rod or line to distant bodies, but that the same rod or line will communicate that virtue to another rod or line that is at a distance from it; and by that other rod or line the attractive force may be carried to other distant bodies.

A small hoop of about 20 inches in diameter, and 1 inch and ½ in breadth, being suspended by 2 threads of silk; so that it hung perpendicular, and in a plane at right angles to the horizontal line of communication, which passed thro', or at least very near to the centre of the hoop, he went to the end of the said line, and applying the excited tube near it, there was an attractive influence communicated to the hoop in all parts of it: Then by a screw-hole made in the side of the hoop for that purpose, he skrew'd it upon the top of a pedestal that was about 2 foot and ½ in height, setting it upon a cake of rosin; so as that the beforementioned line might pass thro' the centre of the hoop; and he found that whether the hoop was placed so as that its plane was at right angles, or in any other angle with the line of communication, the hoop attracted after the same manner, as it had done when suspended on the silk lines.

Some

Some time after he made the following experiment: Into the nose of a glass-funnel he put the larger end of the top of a small fishing rod, and upon the lesser end a ball of cork: Then the funnel was set on the floor of the room; so that the rod was at some inches distance from the line of communication: Then the tube being excited, and applied near the end of the line, the electric virtue was convey'd by it to the cork-ball; and it attracted strongly when the ball was, by estimation, not less than 2 foot distance from the aforesaid line.

Dec. 11. There being a hard frost, and a fair day, he repeated the experiment, making use of a large hoop that was about 40 inches diameter, and setting it perpendicular upon a hollow cylinder of glass, which was 6 inches long, and 5 inches and ½ in diameter; placing the hoop in such a manner that the line of communication might pass thro', or at least very near, the centre of the hoop: Then applying the tube to the end of the line, there was an attraction communicated to all parts of the hoop, attracting a pendulous white thread at the distance, by estimation, of about ½ an inch: He then set the hoop in such a manner as that the internal surface of the hoop might touch the line; and then communicating an attraction by the excited tube to the packthread, its attractive virtue was carried by it to the hoop, and caus'd it to attract with such force, as with the remotest part of the hoop to attract the thread at a distance, by estimation, of about 4 inches.

Some time after, he made the following experiment: The large hoop being set upon the glass cylinder, and the packthread passing thro' or near its centre, the tube being applied near the hoop gave it such a strong attraction, that it would attract a thread at the distance of 7 or 8 inches, and at the same time there was an attraction communicated to the packthread: Then he suspended an ivory ball of 2 inches diameter at the other end of the packthread, and applying the tube to the hoop, there was an attractive virtue carried to the ball, and it would attract the pendulous thread at the distance of near an inch. He then placed the ball in or near the centre of the hoop, and now it was so far from being attracted, that it was repell'd by the ball, but attracted by the packthread, passing to it in the arch of a circle, whose centre seemed to be that of the ball.

The Sequel of the Meteorological, &c. *Observations at* Utrecht, *for the Year* 1730; *by M.* Muschenbroek, Phil. Trans. N°. 426. p. 408. *Translated from the* Latin.

WERE philosophers to apply themselves unanimously to observe and set down their observations of meteors all over the earth, we should soon have a compleat history of the annual, variable and constant winds and monsoons: For, whoever would compare together these journals, would manifestly discover the origin of each wind, the tract it had pass'd over, and where it had ended: He would also see, how clouds, carried by winds towards some parts, were comdensed by contrary winds, or by other clouds mixing with them, and generated from different parts of the earth; and how they should produce rain, heighten new winds or add strength to them, cause effervescences, and produce thunder and lightning; the cause of all which, we now either guess at, or are ignorant of: He would likewise see the frame and constitution of the whole atmosphere; of which we hitherto scarce know any thing for want of observations. But it is matter of regret, that very few learned men take the pains of compiling such sort of journals, as there can hardly be any light and advantage drawn from comparing one or two journals together: The ingenious Dr. *Jurin* has, it is true, by his invitation for making meteorological observations, excited some, who have chearfully undertaken this task: In the *Act. Erud.* for 1730, there are very accurate meteorological observations, which compared with M. *Muschenbroek*'s shew, how much the atmosphere varied at *Leipsic* and at *Utrecht* on the same day; how different the winds were, and how much greater the gravity of the atmosphere was in the one place than in the other: But to return; *January* was exceeding moderate as to cold, and had several fine days: It freezed; but at the coldest, the thermometer only fell to 18 degr. and but once on the 21. the mercury in the barometer was at 29 inches and $\frac{10}{12}$, which is so considerable a height that M. *Muschenbroek* does not remember to have ever observ'd a greater. The sky being so fair and serene, and subject to no considerable or sudden changes of heat, had almost banish'd all kinds of distempers, except the small pox, which were of the confluent kind, and malignant, and of the nature of those mention'd at the latter end of 1729; yet fewer died of them. He left the magnetic needles in the same state as the preceeding year,

year, being unwilling to impregnate them with new virtue, by drawing them over the magnet: The magnetic virtue, continu'd pretty vigorous for the whole year in the inclinatory needle; what happen'd to the declinatory one in *May*, shall be shewn anon.

The greatest inclination this month was 73° 25′; the least 72° 45′. The greatest declination was 13° 21′; the least 12° 58′.

February was pretty wet, moderately cold, with few northerly winds; there were no considerable or sudden vicissitudes of heat or cold in the atmosphere; whence the number of the sick was very small: Yet the small pox of the confluent kind continu'd, but less malignant than the former. On the 15, at 10 in the evening M. *Muschenbroek* discover'd an *aurora borealis*, or a bright cloud only that shot forth no radiations: But as it had nothing uncommon, he did not take up much time in observing it. In *Phil. Trans.* N°. 413. p. 279. an *aurora borealis* of a very calm light was observ'd the same day at *Geneva*, and a elegant description of it communicated to the *Royal Society*.

The greatest inclination of the magnetic needle was 74° 10′; the least 73° 15′. The greatest declination was 14° 6′; the least 13° 8′.

March was exceeding rainy. The mercury in the barometer was generally low; yet there were no storms, for which this month is otherwise remarkable: There were very few northerly winds; hence the air was healthful, scarce conveying or disseminating the seeds of diseases: And now the small pox became milder; and here and there the distinct kind; nor were the confluent so rife, or fatal as in the preceeding months. On the 6th at 8 in the evening, M. *Muschenbroek* observ'd an *aurora borealis*; it was small: A little cloud in the north 10 degrees above the horizon, terminated by an uneven superior limb, white above and blacker below, emitted some shining short rods, scarce 30 degrees, above the horizon, succeeding each other; yet at a considerable distance of time: At 10 o'clock there was no trace of it.

The greatest inclination of the magnetic needle was 75°; the least 66° 15′. Yet here something extraordinary happened, for, the greatest inclination on the 25th being 75°, the day following it was only 66° 15′; yet there was no assignable cause for this difference; and this inclinatory needle

needle is of ſuch a nature and goodneſs, that if it be mov'd out of its ſituation, in an hour it will again ſhew the ſame degree of inclination: He was more ſurpris'd at this difference of inclination; as the other needle that ſhews the declination, only exhibited the difference of one minute. How many things then in magnetics ſtill remain to be clear'd up by poſterity! Amongſt all the obſervations made this month on the inclinatory needle, he obſerv'd conſiderable variations; but thoſe in the declinatory needle were the feweſt of any month.

The ſucceeding *April* was pleaſant and moderately dry; by whoſe genial heat both trees and plants budded, which gave great hopes of a plentiful harveſt; twice thoſe plentiful thunders roared, and once an *aurora borealis* appear'd exhibiting nothing uncommon. Again the ſmall pox were not ſo riſe: Vernal intermitting tertians made their appearance as uſual; neither obſtinate nor malignant; nor common, and without unuſual ſymptoms. Here and there he obſerv'd *peripneumonia*'s, but they were favourable, and ſometimes went off ſpontaneouſly, and ſometimes they requir'd veniſection and medicines: Very few died of them.

The greateſt inclination of the magnetic needle was 72° 30′; the leaſt, 68° 45′. The ſame prodigy happened this month as the former; namely, the needle returning from the greateſt inclination to the leaſt on the following day, whilſt the declinatory needle was ſcarce affected. The greateſt declination was only 13° 7′: the leaſt 12° 46′. The compaſs needle this month had a conſiderable retrograde motion.

Thunders were very frequent in *May*, and ſcarce at any other time more ſo: *May* is always productive of thunder in theſe parts: For, the earth being conſtringed by the cold of the preceeding winter can ſcarce tranſpire the oils, ſulphurs and ſalts contain'd therein; as ſoon then as it is opened by the heat of *April* and *May*, there riſe plentifully into the air oleaginous ſaline and other different exhalations; which mixed together, produce an efferveſcence, are ſet on fire, and cauſe thunder and lightening.

In the beginning of the month the winds were northerly; upon which there immediately aroſe *angina*'s and coughs: All the *angina*'s were of the inflammatory kind; the almonds of the ears were exceedingly ſwell'd and red; nor could they be cured without plentiful repeated veniſection, cathartics, fomentations

tions externally applied to the *fauces*, gargarisms, and diluent potions: this wind likewise made tertians more rife, than which there is no greater enemy to the human body: The small pox still continu'd, but milder and not so rife.

The greatest inclination of the magnetic needle was 72° 25′; the least 70° 45′. He observ'd the declination till the 19, on which it thunder'd at 11 in the forenoon; he observ'd the thunder pass over the houses, but so high in the air, that he expected no execution from it: At 12 he came to observe the declination of the magnetic needle; upon taking off the cover he was called away; in this time there was a small shower of rain, which somewhat wetted both the glass that covers the box, and the needle itself; having carefully wiped the needle he put it upon its pin, when it became paralytic, as it were, and divested of its magnetic virtue, and continued at rest in what sever situation it was put; he drew it along a generous magnet, but it could not be excited, tho' he took care not to direct it towards any point to which other needles had been drawn: He polish'd and cleaned the cavity of its pivot, repeated the application of the needle to the magnet, but all to no purpose, and this accident caused a gap in his observations. Whether this effect proceeded from the thunder, he does not take upon him to affirm; but it happen'd at that time; and if it touch'd the needle, it may in some measure be explain'd from the analogous observations, M. *Muschenbroek* collected in his *dissertation on the magnet*. There were but few fair days in *June*; the weather was very moderate: Hence acute diseases were very rare; intermitting tertians still continued, but pretty favourable, and were very easily cur'd; and now the small-pox, that had raged upwards of a year, were very rare: The greatest inclination of the magnetic needle was 74° 31′; the least 71° 50′.

July, was very rainy, and not above a day or two of it fair: The heat was much less than is necessary to ripen the fruits of the earth. The fields were all under water; and such as were never before cover'd with it, now look'd like a sea, and were 2 foot under water: The *Lecca* would have overflow'd the dykes, had it not been for the care of the magistrates: Now the husbandman began to despair of his harvest, and anxiously look out for the higher pasture-grounds for his cattle. Yet this month was not every where so rainy; for, from *Richter*'s observations at *Leipsic*, it appears they had several fine days; as they also had in *France*: And however wet *July* was; yet

yet it did not produce any diseases, and generally this month finds little employment for physicians.

The greatest inclination of the magnetic needle was 77° 25′; the least 72° 15′.

The beginning of *August* was likewise very wet: Both apples and pears rotted from the trees, of which there was a great scarcity in the diocese of *Utrecht*: what wretched corn was there, the small grains of wheat yielded a great deal of bran, but little meal; and the greatest part of it continued growing by reason of the continual rains: And this corn could hardly find buyers: Intermitting tertians and quartans began like the autumnal, but were pretty favourable: There were likewise simple synochi, which exhibited no peculiar symptoms, nor had any uncommon periods. The greatest inclination was 76° 30′; the least 70°.

Sept. was again rainy; yet there were some fair days in the beginning; but none after the 12th. On the 10th appear'd an *aurora borealis* from 10 till 11 o'clock, that emitted bright rods from a cloud in the north, scarce raised above the horizon, and exhibited nothing uncommon.

Now several intermitting tertians and quartans were observ'd and those not unkindly; besides, as the heat was moderate, there hardly reigned any other acute disorder.

The greatest inclination was 70° 30′; the least 69° 15′.

In *October* the air, it is true, was deprived of the greatest part of its rain, but colder from the earth's being drenched the foregoing months; there were likewise few clear days: Hence the grapes did not ripen in these parts; but it happen'd otherways in *France* where the months of *Sept.* and *Oct.* being pretty warm, grapes ripen'd very well, and yielded very generous wine, and preferable to any of the preceeding years. There were likewise few distempers this month; only some simple and double tertians, as also quartans, but they not obstinate.

There was a deal of rain in *November*, yet the cold was moderate: And because the whole year was wetter and colder than ordinary; the oxen were very brisk and lively, in the pastures, became very fat; as did also all sorts of birds, fowl and wild game: So that the loss of fruit was made up by the fatness of the oxen. On the 5th and 6th day M. *Muschenbroek* observ'd an *aurora borealis*, that exhibited nothing uncommon: These were the 2 last *aurora*'s of this year; so that they shone six times: He observed by viewing all of them, that they are noways

ways affected, whatever winds do blow, or from whatever quarter they come. But since at first they always appear in the north, and from thence are carried towards the south, the matter of them floats higher in the atmosphere, than where the lower winds do reign: *Auroræ boreales* are carried from north to south; and that doubtless by the wind of the superior region of the atmosphere, which blows in that direction.

Now the inclinatory needle was most depress'd under the horizon, forming with it an angle of 69° 30′; and least depress'd, with an angle of 68° 50′.

In *Dec.* there was observ'd a sudden change of the weight of the atmosphere: For, on the 22d at night the mercury in the barometer standing at 28 inches $\frac{8}{12}$, in the morning ascended to 29 inches and $\frac{1}{2}$; which change happen'd within the space of 8 hours.

The greatest inclination was 69° 25′; the least 67°.

The latter half of the year the air was very healthful; so that diseases were few, and as few people died; nay, the greatest mortality was by the small pox for the first six months of the year.

The quantity of rain that fell this year was 33 inches 5 lines and $\frac{1}{3}$ perpendicular height: and only 28 inches 1 line and $\frac{1}{3}$ evaporated; so that there fell more rain than was evaporated, which very rarely happens; but this was owing to the cold and wetness of the year.

The Sequel of the Register for the Year 1731; *by the same.* Phil. Transf. N°. 426. p. 417. *Translated from the* Latin.

JAnuary brought a moderate cold along with it: What happen'd worth observing this month is as follows: It freez'd a little on the 14th, 15th, 16th, 17th, tho' the mercury in the barometer was exceeding low, and the winds southerly, but gentle: At this M. *Muschenbroek* was surpriz'd; since he seldom or never observ'd a frost begin, when the barometer was so low, and such winds blowing; his surprize ceas'd when he heard that there had been great storms on the coasts of *Spain* and *Portugal*, that had caus'd several shipwrecks; the wind in those parts being southerly, and also reaching as far as our coasts would have exerted its force upon our atmosphere, had not a north wind directly oppos'd it; and hence proceeded the calm; in the same manner as equal and contrary forces destroy each other: And either the south or north wind was

was obſerv'd to blow as the one or the other prevailed: With what reſerve then muſt we judge of the future condition of the atmoſphere from the height of the mercury in the barometer. For, on the 26th, 27th, and 28th of this month it thaw'd, tho' the mercury was very high, and the wind eaſterly: So that the anomalies of the barometer are hardly credible.

There were ſome inſtances of the ſmall pox, and theſe generally of the diſtinct kind, of which a few young children died. From the middle of *January* pleuriſies began, which only ſeiſed the labouring and country people; which were of a more kindly nature, and ſeldom tending to ſuppuration.

There were alſo double tertians, which were ſoon and happily cured by the uſe of the ſalts and bitters only.

Coryza's immediately enſued the thaw: This month the *Lecca* was pretty low. And now M. *Muſchenbroek* had procur'd ſome new ſea compaſſes, in order again to obſerve the declination of the magnet: He had left an inclinatory needle to itſelf, that he might obſerve whether the magnetic virtue, communicated to it 2 years before, ſtill continued vigorous: And he found that the virtue was exceedingly diminiſh'd this year; ſo that he thought proper in *Dec.* to draw the needle again along the magnet; upon which it had much greater inclination; yet he ſuſpects that it retain'd its virtue pretty well till *June*. From theſe diſcoveries M. *Muſchenbroek* thinks, that common ſea-compaſſes can never be ſafely depended on above 2 years, without touching.

The greateſt inclination this month was 68°; the leaſt 67° 20': The greateſt declination was 14° 55'; the leaſt 14° 15'.

February was attended with a laſting, but moderate, froſt; it began on the 2d, and continu'd without interruption till the cloſe of the 21. After the 6th, the mercury till on the 8th and 9th it came almoſt to its loweſt ſtation; the ſky, however, ſerene, the winds gentle, from whatever quarter they blew, and the froſt continuing. But as the year began with ſuch irregularities, it inclined to continue in them. On the night of the 5th day there was much lightening; in other cities in *Holland* there were terrible thunder peals, eſpecially over *Alſmeria*: On the 12, between 6 and 8 in the evening there fell a great quantity of ſnow, 15 inches deep, intermixed with very ſmall and fine rain: M. *Muſchenbroek* never obſerv'd ſuch a prodigious quantity fall in theſe parts in ſo ſhort a time: The melted ſnow yielded 20 lines of water; conſequently,

quently, this ſnow was only nine times rarer than water: This happened on the night preceeding the moon's quadrature: The *Lecca* was froze over: After the 20th there was a very gentle thaw, which happily diſſolving the ice of the rivers, the dykes ſuſtained no damage.

During this cold almoſt all diſorders lay huſhed; only the ſmall pox of the diſtinct kind prevailed; they were favourable, ſcarce carrying off any one. A great fall of ſnow, with the northerly winds following thereon, after the 12th, caus'd arthritic pains which would have been more ſevere, had either the cold been greater, or the northerly winds continued longer; but the more kindly ſoutherly winds gave no ſmall relief in this diſorder: For when the froſt had for 18 days together without intermiſſion conſtringed the bodies of men, the perſpiration was hindered. And hence a *diarrhœa*, which did not ceaſe till the ſuperfluous matter in the body was thrown off, and a free perſpiration reſtored: The ſpeedieſt remedy, therefore, was a ſtrong cathartic, and then a gentle ſudorific. But others were ſeiſed with an inflammatory *angina*, rather more laſting than dangerous; it was ſoon removed by veniſection, and eſpecially by repeated cathartics. After it began to thaw, and the air became moiſt with rain, there aroſe coughs, by the moiſter ſoutherly winds very much relaxing the veſicles of the lungs; ſo that the laxer and too patent mouths of the excretories lodged here a great quantity of phlegm, which muſt be thrown off by coughing.

The greateſt inclination was 68° 30′; the leaſt 68°: The greateſt declination was 14° 20′: the leaſt 13° 45′.

In *March* the winds were generally northerly, which equally affected animals and vegetables: And hence aroſe ſeveral diſorders, as arthritic pains, pleuriſies, acute continual fevers, intermitting tertians, quartans and the ſmall pox: After the 14th he obſerved that ſuch as were phthiſical became much worſe, with great anxieties, for which he could ſuſpect no other cauſe than the foregoing laſting northerly winds.

On the 7th in the evening he obſerved a ſmall *aurora borealis*, and without any thing uncommon.

The greateſt inclination was 69° 15′; the leaſt 68° 20′: The greateſt declination was 14° 50′; the leaſt 13° 30′. Between the 5th and 6th the difference of declination was equal to 1°; the inclination continuing invariable.

April was dry, exceeding cold, inſeſted with northerly winds, and backward: Hence, tho' this month was over, no tree

tree had hitherto budded; about the close of it apricots began to blossom, but they were nipp'd by the cold; after this the peaches lost their blossoms, and suffered much by the cold; yet the remaining fruit was the better for it.

And now disagreeable and cold northerly winds caus'd more frequent arthritic pains; there were simple and double tertians, like the vernal, but more rife, tho' noways malignant or obstinate.

The greatest inclination was 70° 40'; the least 68° 45': The greatest declination was 16°; the least 14° 25'.

May in the beginning was unpleasant and cold; but on the 5th in the afternoon there happened suddenly a very great alteration, by warm showers of rain rendering the air milder: Hence on the following days both leaves and blossoms broke out in abundance, had not very cold nights from the 10th to the 15th nipp'd every thing again: Hence pulse were prevented in their growth, the earth being covered every night with a thick crust of ice. After it had thunder'd on the 18th, the weather began to be milder. On the 5th day from the sudden change in the atmosphere, from cold to hot, there immediately came on *angina*'s, which yet were slighter and went off spontaneously. The day following he observed colic pains without fevers, which in the night time affected the most healthy: M. *Muschenbroek* could assign no other cause for this than the sudden vicissitude of heat and cold; he should have overlooked this disorder, had not he, upon visiting his patients that day in the morning, heard the first 4, who lived in different houses, complain of these pains; and then suspecting that this disorder was owing to the air, and that there was a slight inflammation of the intestines, he thought proper to open a vein, and this prov'd very successful; and in such patients as he omitted venisection, prescribing only hot spirituous potions with opium, the disorder continu'd for 3 days, and was not removed without venisection and diluents. At the same time there were hoarseness and coughs, without a fever, and these were heighten'd after midnight; they proved very obstinate, without yielding either to venisection, cathartics, sudorifics or lenitives, and they requir'd a longer time, as also preparations of honey, and opiates.

On the 14. there appeared a *lumen boreale*, which exhibited nothing, but what had been several times observed before. The greatest inclination was 72° 50'; the least 68°: The greatest declination was 16° 13'; the least 15°.

In *June* he obſerved ſimple ſynochi, without any malignity; they were, therefore, eaſily cur'd by a plentiful veniſection, together with nitrous, diluent, and cooling, potions. The ſmall-pox were the mildeſt that ever were ſeen: They were of the diſtinct kind, few in number and ſmall; with theſe ſome young children had little or no ſickneſs, and were not obliged to keep their beds; and now on the 6th all the puſtules ſuppurated, and they quite dried up on the 9th. But there were very bad *coryza's*, that continued very long, by reaſon of the great variety of weather: For, if one day was very hot, the next following would be very cold, and this was cauſed by northerly winds. M. *Muſchenbroek* ſuſpects that all the inclinations of the magnetic needle from this month till *December* were leſs than they ſhould have been from the diminution of the magnetic virtue by length of time. The greateſt declination was 16° 30′; the leaſt 15° 50′.

On the 24th of *July* there were ſuch terrible flaſhes of lightning, with ſuch loud peals of thunder, that M. *Muſchenbroek* never ſaw nor heard the like; they began at ½ an hour after 4 in the afternoon, and ended at 6; yet they did not do much damage to the city; only here and there ſome ſtones were thrown down from the chimney heads, tiles from the houſes, and 2 trees near the city were rent, and ſome of the bark peel'd off, where the lightening had run along it: A citizen, who had taken ſhelter under one of the trees, was thunder ſtruck.

Now for the whole of this month the weather was mild, moderate, ſerene, and forward: Hence there was a fruitful harveſt, that made amends for the ſcarcity of the foregoing year: So healthful was the ſeaſon, that ſcarce any were ill. The greateſt declination was 16° 10′; the leaſt 15° 40′.

Auguſt was exceeding hot; but the weather ſo mild, favourable and healthful, that men could not wiſh for a better: Hence there were very few complaints: Fruit this year was very good and ſo plentiful, that it ſcarce bore any price.

The greateſt declination of the magnetic needle this month was 16° 5′; the leaſt 15° 35′.

In *September* the weather was likewiſe moderate and mild, infeſted with few northerly winds: It produced inflammatory *angina's*, ſome more acute, and others more mild, as alſo intermitting tertians and quartans, yet leſs in the city than in the country: Theſe were of the autumnal kind, which neither yielded to lixivious ſalts, or bitter antifebrils: But M. *Muſchenbroek* happily cur'd ſeveral patients with a vomit; ſometimes repeat-

repeating it twice, and then giving a bitter decoction for a few days, and after that the bark; by which method the *angina* was entirely removed, and that without any relapse.

The greatest declination was 15° 55′; the least 14° 20′.

October was very fertile in *auroræ boreales*; for, there were five in that month. On the third, from 8 in the evening till after 12, the sky being exceeding calm and still, there appear'd a large *lumen boreale*, that slowly emitted its columns from the horizon to the zenith; these columns lasted for a very long time uninterrupted by any wind.

On the 7th a large *aurora borealis* illuminated the whole heavens with a light exceeding that of the moon in her quarters; at 7 o'clock it began in the north east, but it also gradually spread to the west; so that at the same time it shone thro' the tract of the heavens from north east to west; and so far it extended at 11 o'clock: Near the horizon the sky was overcast with a white cloud, denser than that it could transmit the light of the stars: From this cloud there sometimes arose a part like a column, and sometimes a part of the cloud was broken off, of an unequal figure; which thus divided shone, and mov'd slowly to the zenith; for, there was no wind near the surface of the earth; and besides, it exhibited nothing particular.

On the 8th in the evening there again appear'd an *aurora borealis* in the N. E. There were several interrupted, small black clouds, over which stood others pellucid, shining and without motion, that emitted neither rays nor columns: Two winds blew at the same time; the higher, a northerly, and the lower, a southerly wind. The lower part of the higher wind running against the upper part of the clouds, carried off some part of them, which being exceeding rare, and agitated by an intestine motion, began to shine: From these parts swept off, were sometimes emitted rods; yet from the other clouds there shot at times a column, which shone a little. The other *auroræ* exhibited nothing particular.

The air was very healthful all this month: Hence, very few disorders, except towards the close of it, simple, and double tertians, and intermitting quartans in the country; but not so rife in the city: And because apples and pears were in such great plenty this autumn, and very cheap, the common people eat too many of them: Hence arose dysenteries, especially in the country, but not so common in the city; yet they did not spread, nor were they catching.

The

The greateſt declination was 14° 30′; the leaſt 14°.

The weather was moderate and mild till *November*; ſo that it ſeemed the approach of a temperate ſummer, and not the autumn. On the 10th M. *Muſchenbroek* obſerv'd the trees ſtill green, and very few yellow leaves fallen from the limes. the wheat ſown this autumn grew too faſt; ſo that the oxen were put to feed on it, and keep it under, that it might be the better able to bear the cold of the following winter. All ſorts of pot-herbs were as freſh in the gardens as if it were in *Auguſt*: So that tho' the ſummer came late, yet it refreſh'd the earth for a long time with its cheriſhing heat: The 26th was exceeding hot, tho' the air was moiſt, and the wind at north.

On the 6th day he obſerv'd an *aurora borealis*, different from any he had hitherto ſeen: For, the ſky was adorned with ſeveral interrupted clouds from the ſouth along the weſt to the north, which all ſtood ſtill in their places, tho' there was a little wind ſtirring; and they ſhone with a white light, that illuminated the whole heavens: The *aurora* the 30th exhibited nothing uncommon: Tertians were very rife; eſpecially double tertians and intermitting quartans; they were not obſtinate, but happily removed by the above-mentioned method. The ſmall pox likewiſe prevailed, not very numerous, but of the confluent and diſtinct ſort, of a kindly nature, and carrying off but few; tho' there were a great many puſtules on the face.

The greateſt declination was 14° 15′; the leaſt 14°.

In *December*, when M. *Muſchenbroek* found that the inclinatory needle had loſt a great deal of its virtue, he drew it again along the magnet, and impregnated it with as much virtue, as it could well take; and it immediately pointed to the true inclination, namely 69° 15′. Being ſeveral times moved out of its ſituation, after ſome number of oſcillations; it return'd to the ſame degree of inclination. The greateſt declination was 14° 21′; the leaſt 13° 23′.

The ſmall pox this month were of the ſame kind as thoſe in *November*: And beſides, there were intermitting tertians and quartans, that exhibited nothing uncommon, nor different from thoſe in the foregoing months of autumn.

The whole quantity of rain that fell this year was only 17 *Rhinland* inches and $\frac{1}{3}$ perpendicular height, ſo that it is to be reckoned among the drier years. There evaporated

17

17 inches 10 lines and ½, which is nearly the quantity he obſerv'd the preceeding year.

An extraordinary foſſile Scull of an Ox, *with the* Cores *of the* Horns; *by M.* Klein. Phil. Tranſ. N° 426. p. 427.

NEAR the city of *Dirſchaw* was dug up part of the ſcull of an ox, with the cores of the horns, which in all probability muſt have been prodigious.

Fig. 8. Plate X. repreſents the outſide of the ſcull to the orbits of the eyes; *a b* three foot two inches and a half; *c d* 1 foot 1 inch and ⅓; *e f* 1 foot 4 inches; *g h* 1 foot 1 inch and ¾; *i* K the root of the horns 1 foot 6 inches in circumference; *l m* the cores 11 inches in a ſtreight line, theſe cores have deep longitudinal furrows; they are not entire at the extremities, and yet are diſtant from each other.

Fig. 9. repreſents the baſis of the ſcull.

Fig. 10 the *occiput*.

M. *Klein* does not take upon him to determine to what kind of bulls this foſſil belonged: He only conjectures it may belong to the taurelephants mentioned by Sir *Hans Sloane* *Phil Tranſ.* N° 397. p. 222. And as to the *Zubrones*, which *Geſner* on the *urus* p. 144. mentions from *Munſter*, there is no ſufficient proof that the animal in queſtion was of that kind.

A farther Account of a remarkable Plica Polonica; *together with a prodigious Swelling of the Eye; by M.* Klein. Phil. Tranſ. N° 426. p. 428.

THIS ſurpriſing *plica polonica (vide Phil. Tranſ.* N° 417. p. 50.) was ſent to *Dreſden*, where M. *Klein* ſaw it. It is remarkable, that the woman (Fig. 11. Plate X.) affected with it, who liv'd in the diſtrict of *Novogrod*, during 52 years that ſhe laboured under it, never changed her reſting place, but twice a year, *viz.* in ſpring and winter. Upon the approach of winter ſhe could endure cold ſo very well, that ſhe ſhunn'd all ſort of heat, even that of a lighted candle. She never us'd any ſtrong liquor, but liv'd on very bad bread, raw herbs, and water, to 70 years of age; ſhe died in 1728. In the ſpring ſhe was wont to be carried to ſome place where the heat could not eaſily penetrate.

Fig.

Fig. 12. repreſents a prodigious ſwelling in the eye of a ſubject of the Princeſs of *Radzivil*; it was occaſioned by hail, and it daily encreaſed and grew hard, except at the place marked *a*. This circumſtance is very ſingular, that the optic nerve and the tunicles had ſtretch'd ſo much, that the eye quitted its ſocket, and fell down to the beard at *b*: He could move this eye which wept; but could not ſee with it. The tumour was not painful, but very troubleſome about the noſe.

Of the Uſe of the Bark *in* Mortifications; *by Mr.* Shipton, Phil. Tranſ. N° 426. p. 434. *Tranſlated from the* Latin.

MR. *Ruſhworth*, a ſurgeon of *Northampton* in a letter to the company of ſurgeons at *London*, dated *October* 18, 1731, informs them, that he was call'd to viſit a patient, who, from an internal cauſe, had a mortification in his foot, reaching to the bones, with a violent fever upon him, and a quick pulſe; and that at firſt he checked the mortification by deep ſcarifications and the uſual remedies, the fever abating, the pulſe becoming more regular, and *pus* appearing on the edges of the ulcer; and that afterwards upon the mortification recurring a ſecond and a third time, and ſpreading farther, he had check'd it by the ſame method: In fine, that having had recourſe to the bark, while the fever remitted, both the fever and mortification were entirely remov'd; and that the patient after amputation had liv'd for ſeveral years in perfect health; and he affirms that he had ſeveral times after this experienced the ſame thing, To this Mr. *Amyand* anſwer'd in a letter dated *July* 29, 1732; that he himſelf had, after the example of Mr. *Ruſhworth*, us'd the bark ſeven times with ſucceſs in a mortification, and particularly in a patient of 78 years of age, who had a mortification in his foot from an inflammation; and as it ſpread farther every day, in 24 hours after giving the bark, the mortified parts began to ſeparate, and a laudable *pus* to appear; as alſo in another mortification, which had for three weeks together baffled the uſual remedies; and in like manner in a third, which proceeded from the punctures made in the legs in a dropſy, the good effects of the bark appeared, the mortification being check'd in one days time; tho' this patient happened to die, as he alſo laboured under an incurable jaundice, and was exhauſted both by the diſtemper, evacuating medicines

medicines, and a gangrene in one of his legs: And from these instances he thinks it pretty evident, that the bark is no less infallible in curing mortifications, from what internal cause soever they are, or at least in checking them, than in removing intermitting fevers.

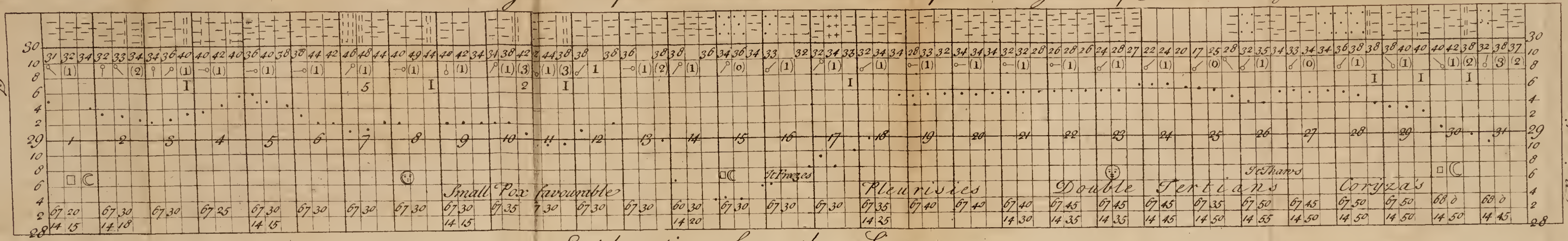
Besides, it is worth observing, that Mr. *John Douglas* in a letter to Mr. *Rushworth* dated *July* 5, 1732, tells him, that he was call'd to a patient of 50 years of age, who had a mortification in his foot from an internal cause; and after scarifications, and alexipharmics, both internal and external, and the other usual remedies, had prov'd unsuccessful for some time, the mortification spreading daily, that at length by administering the bark, which Serjeant *Dickens* and Mr. *Cheselden* had both advis'd him to try, the mortification was immediately checked, the fever abated, and in a little time all the mortified parts, as the tendons, ligaments, and all the bones of the foot, *metatarsus* and *tarsus*, suppurated spontaneously, and the patient recovered: All this Mr. *Rushworth* published in a small treatise in *English*; of which Mr. *Shipton* has here given an abstract, with an account of what he himself observ'd in the use of the same remedy.

Mr. *Shipton* was call'd to visit a gentleman of 50 years of age, who, from a too liberal use of wine, and a *cachexia* arising from thence, had an inflammation in his foot, that turned into a mortification of the toes and *metatarsus*: Tho' alexipharmics, and other proper remedies, both internal and external, had for several days been us'd, yet the mortification spread every day deeper and wider with a fever, rather slow than anyways violent, and a spurious *diabetes*, or a plentiful discharge of a more limpid urine. For removing all which, especially since the increased quantity of urine seem'd to require the astringent qualities of the bark, and since both Mr. *Rushworth*'s and Mr. *Amyand*'s trials promis'd success, Mr. *Shipton* propos'd it to the physicians and surgeons; to which they easily agreed, since they were satisfied from several fruitless trials, that amputation would be of no service: But tho' two scruples of the bark were given every four hours for some days together, yet it seem'd ineffectual in removing either the *diabetes* or mortification; the former exhausting the vital moisture, and the latter by its spreading still farther, consuming the flesh, the patient died in about two weeks time.

Th:

Meteorological Ephemerides at Utrecht for the Year 1731.

Fig. I.



Explanation of the Signs.

Height of Barometer

Height of Thermom. is express'd by the Numbers in the uppermost Row of each Month.

Rain. Snow. Hail. Fog. Thunder. Lightning

Sky overcast with thin Clouds. With several Clouds. With dense Clouds. Aurora Boreal. express'd by

Phases of the Moon

Strength & Coasting of the Winds (1) (2) (3) (4)

D 74 (&c) number of the Dead

Fig. VII.

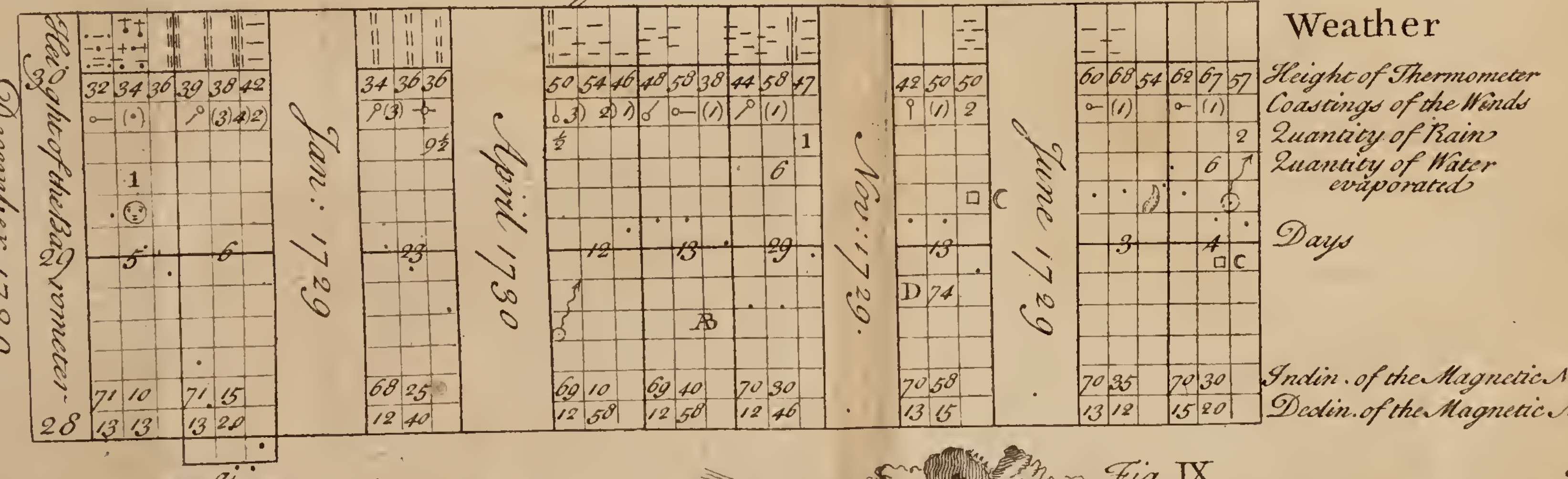


Fig. II.

Fig. III.

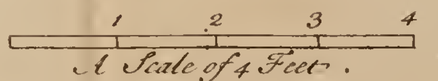


Fig. VI.

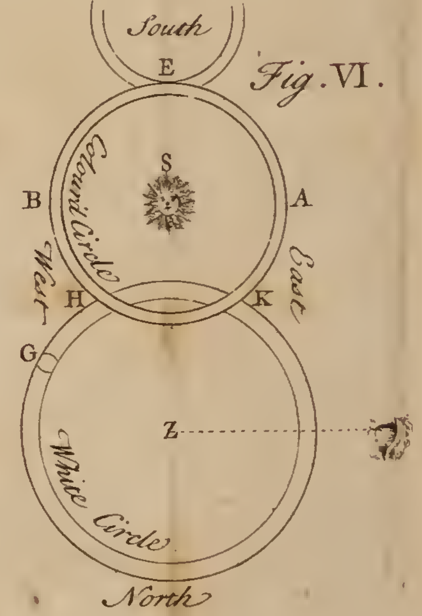


Fig. IV.

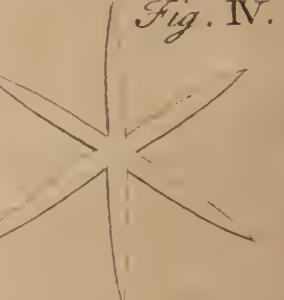


Fig. V.

Fig. VIII.

Fig. IX.

Fig. X.

Fig. XI.

G. Smith delin.

Hulett Sculp.

The bark prov'd more ſucceſsful in a patient of about 35 years of age, of a melancholic ſcorbutic habit; for, drawing a charge of powder out of a fowling piece, and unwarily clapping the palm of his right hand on the muzzle, the piece happen'd to go off; he receiv'd a wound thro' the middle of his palm, extending wide and deep between the thumb and fore finger, whereby the veſſels and tendons were lacerated; the hemorrhage being immediately ſtopped, his hand was dreſſed; for ſome days the patient had a grievous pain, with a large ſwelling and inflammation in all his fingers except the thumb, and all over his hand and arm; and nothing came out of the wound but a large quantity of ichor, at firſt of a bloody, and afterwards of a duſkiſh colour, and ſomewhat fetid; and the wound itſelf of a blackiſh colour ſpread farther every day, and the ſwelling, inflammation, and pain, were ſcarce diminiſh'd, tho' recourſe was had to the uſual remedies in ſuch caſes. But on the eleventh day there flow'd ſpontaneous at four ſeveral times in the ſpace of 24 hours ſome ounces of blood, which likewiſe twice ſtopp'd ſpontaneouſly, and was twice ſtenched by applying *ſp. terebinth.* and compreſſing the hand; and now the lips of the wound plainly appear'd mortified, and the actual cautery ſeem'd to be the laſt reſort, both for ſtopping the homorrhage, and the progreſs of the mortification, ſince the one baffled fomentations and cataplaſms, and the other, bandages; but if the cautery ſhould not ſucceed, recourſe muſt be had to amputation, which, how doubtful a remedy in bodies of ſuch a habit is ſufficiently evident from experience: And in order to put a ſtop to both, he likewiſe thought proper to try the bark, of whoſe efficacy he had then heard a great deal: On the 12th day, therefore, two ſcruples of the bark were given in the morning, and repeated every four hours: Next morning after the patient had taken half an ounce of it, Mr. *Shipton* found the pain very much abated, the ſwelling of the hand fallen, and a little *pus* obſerv'd about the lips of the wound within the bandage; and the edges which the day before were black with the mortification, now ſeemed to begin to ſeparate. The fever, likewiſe, which at firſt was noways violent, yet pretty ſenſible, when the hemorrhage encreaſed, now entirely ceas'd, the urine depoſiting a little ſediment of a dirty or whitiſh yellow, rather than of a lateritious or roſe colour. The uſe of the bark was continued in the ſame manner for two days, and afterwards for two days more it was taken thrice a day, and for 3 days more only twice a day so that there were 2 ounces of it given in one week. In the mean time the ſwelling and inflammation vaniſh'd, a pure *pus* flow'd from the wound, the fleſh grew underneath, and the pain, which yet ſtill continued pretty ſharp in the *carpus*, when the patient mov'd it, was much abated. For 3 weeks after he was very well, only that he had rheumatic pains (with which he was uſually troubled in winter) ſometimes in his foot, and ſometimes in the acromion, and one or both *ſcapula*'s, accompanied with a ſwelling; he was free of a fever, and had an appetite for proper food. But afterwards on the 19. of *December*, his appetite became weaker, the pain in the *metacarpus* together with the ſwelling increaſed; which ſeeming to heighten the day following, the pulſe became ſomewhat quicker on the 3. day, and the ſwelling of the *metacarpus* together with an inflammation threaten'd an *abſceſs*, while there flow'd a white *pus* from the wound, and in the ſame quantity, as before. But on the 4. day, the lips of the wound, ſwell'd with veſicles, tended to a gangrene, with a plentiful diſcharge of *ſanies* without any *pus*, and the hand and *carpus* were inflamed, and pained much: Upon giving, therefore, the *bark* in the ſame manner, as before, within the ſpace of 8 hours, the patient having ſcarce taken 3 doſes, the pain, which before was very ſharp, was laid as by a charm, and the next dreſſing the ſwelling of the hand ſeem'd to abate by one half, and a laudable *pus* to run from it. At firſt the urine was of a pretty intenſe colour, and then it gradually became more dilute, with little or no ſediment. After this to prevent a relapſe he gave ½ an ounce of the *bark* every week for 6 weeks, having given 2 ſcruples twice every day for 3 days; and at length after 4 months he compleated this laborious cure, in which, all the tendons of the *muſculi perforati* and *perforantes*, excepting thoſe of the little finger, were impoſthumated; and a bone of the *metacarpus*, and another of the *carpus*, was laid bare; and he cur'd one or two *abſceſſes* on the back of the hand.

From theſe hiſtories, and eſpecially from the laſt, Mr. *Shipton* thinks it pretty evident, that here nothing is to be aſcribed either to the joint virtues of other medicines, to the peculiar diſpoſition of the humours, to ſome unknown *idioſyncraſia*, to the ſpontaneous remitting of the ſymptoms, to a fortuitous criſis and ſalutary evacuation by other ſecretions, or in fine to chance, but that the whole ſucceſs is ſolely to be aſcribed to the virtues of the *bark*. But tho' in the abovemention'd hiſtories the powder

der of the *bark* is only ſaid to be uſed; yet ſhould any one on account of a weak ſtomach, or for any other reaſon decline it in that form, Mr. *Shipton* thinks that half that quantity of the reſin or extract of it would have the ſame effect, ſince we daily ſee that preparations of the *bark* have the ſame efficacy in intermitting fevers, where its chief virtue appears, as the *bark* itſelf. But ſhould any one from the firſt hiſtory, related by Mr. *Ruſhworth* (where he was afraid of adminiſtering the bark, while the fever was continual, and deferred the uſe of it, till it remitted) contend that there was a latent intermitting fever in all the caſes mentioned; and conſequently, that it was not ſurpriſing, if the bark ſhould get the better of it: To this it may be anſwered, that nothing of this kind was obſerved in moſt, nay quite the contrary in ſome of the patients, as pretty good judges of ſuch ſymptoms do teſtify: But in the laſt hiſtory, where Mr. *Shipton* himſelf was as attentive as poſſible to every circumſtance, he cannot ſay that he obſerved any thing of a latent or unuſual fever, of the continent kind, much leſs of the intermitting, nor any febrile ſediment in the urine, nor unuſual heat, thirſt or rigor at a particular time of the day, nor any drineſs or blackneſs of the tongue; and if we impartially conſider the matter, we ſhall find that the fever, whatever it was, was only ſymptomatical, which according to the opinion of the ancients (nor even do the moderns deny it, and the thing is evident of itſelf) could by no means be an intermitting fever: And what principally regards this argument, namely, that the virtue of the bark in checking a mortification, is not from its removing any intermitting or latent fever, Mr. *Shipton* mentions a treatiſe of Mr. *Bradley*'s, a ſurgeon in *London*, in which he ſays, that the uſe of the *bark* had the ſame happy effect in a cachectic and leuco-phlegmatic woman, who, by accident receiving a large and tranſverſe wound on the upper part of the leg, had on the third day a violent fever with a quick and intermitting pulſe, a drineſs and blackneſs of the tongue, a ſtern countenance, and ſome degree of a *delirium*, and a gangrene, poſſeſſing almoſt all the leg; by adminiſtering the *bark* every 4 hours the gangrene was checked in 24 hours time, and the other ſymptoms vaniſh'd: But on the 5th day intermitting the uſe of the *bark*, ſhe had a relapſe; upon her reſuming it, all the ſymptoms abated, and the patient recover'd.

From this hiſtory as alſo from ſome of thoſe mentioned above, it appears that not only the *bark* may be adminiſter'd with

afety, and ſometimes with ſucceſs, while the fever continues;
but likewiſe that this kind of ſymptomatical fever is not of the
genus of the common putrid fevers, which is, therefore, by
ſome medical writers referr'd to its own peculiar *genus*; nor of
thoſe that are claſs'd amongſt intermitting fevers; ſince in all theſe
phyſicians obſerve that the uſe of the *bark* is generally noxious
and ſometimes fatal; but ſeveral trials evince that it was salu-
tary in this: But theſe things want to be ſtill farther conſider'd
by phyſicians. Beſides, from the abovemention'd hiſtories it i
worth obſerving, that tho' in ſome of them the wounds were th
immediate cauſe of a gangrene, yet that in all of them, th
chief and principal cauſe ſeems to be taken from the ſtate and
condition of the humours; and conſequently, that internal re-
medies rather than the uſual external ones, anſwer'd the purpoſ
with greater diſpatch and ſafety.

The efficacy of the *bark* in ſtopping hemorrhages of th
noſe, lungs, and other parts of the body is ſufficiently known
and Mr. *Shipton* thinks he may recommend it to ſurgeons fro
his own experience for ſtopping a flux of blood in externa
wounds, when the veſſels will not unite by reaſon of the to
great tenuity or acrimony of the blood; and he likewiſe foun
it ſeveral times very ſerviceable in exceſſive evacuations of ex-
crementitious, or even other uſeful juices beſides the bloo
What effect this wonderful *bark* may have in ſome ulcers of th
worſt kind, called *Nomæ* and *Phagedænæ*, and probably,
malignant *Herpes*, Mr. *Shipton* will not take upon him to de-
termine for want of experience; he contents himſelf with gi-
ing this hint, reaſoning from analogy; that ſince a gangre
and mortification are putrid and corroding ulcers, it may ſom
times, probably, have no leſs efficacy in others of that kin
which yet he thinks ſhould not be attempted, without a pr-
vious preparation of the whole body (which may be eaſily do
in thoſe, tho' not ſo in mortifications, in which no time muſt
loſt) and having a regard to the whole habit of the body, a
not without the advice of a learned and prudent phyſician.

Corrections and Amendments to the Natural Hiſtory *of t*
Coccus radicum tinctorius; *by Dr.* Breynius. Phil. Tra
N° 426. p. 444.

IN Dr. *Breynius's Natural Hiſtory* of the *Coccus radicu*
when after ſeveral repeated obſervations and experime
(eſpecially thoſe in p. 16, 17.) he had given an account
the generation and metamorphoſis of that inſect, which uſes

ſt

ſtick to the extremities of the roots like a ſpherical grain, and is commonly call'd *coccus Polonicus*, he conjectur'd that thoſe ſmall flies, which are often found among the *coccus*, did not belong thereto, but ow'd their riſe to ſmall worms of their own kind, and were accidentally found among the *coccus*; and as the Dr. could not find any difference of ſex among the worms of the *coccus*, and following chiefly the opinion of S. *Ceſtoni* concerning the *coccus* of the *ilex*, he ventur'd to aſſert that the *coccus radicum* is likewiſe an inſect of the hermaphrodite kind, which brings forth eggs of, and from itſelf, and propagates its ſpecies without being impregnated by the male. But the ſummer following he was made ſenſible of his error, and about the end of it he was entirely convinced of his being in the wrong.

Having repeated his obſervations with the greateſt exactneſs, and examin'd them in the ſtricteſt manner, he at laſt found that the metamorphoſis, or evolution thro' which the *coccus radicum* paſſes is as follows.

A. Of the male	B. Of the female
I. The egg	I. The egg

The eggs are laid about the end of *July*, or beginning of *Auguſt*.

A. Of the male	B. Of the female
II. A worm with ſix feet and no wings.	II. A worm with ſix feet and no wings.

The worms come out of the eggs about the middle of *Auguſt*, till the beginning of *September*.

III. The leſs ſpherical grain, that is the *coccus* ſtrictly ſo call'd, of the bigneſs of a grain of poppy ſeed or millet at fartheſt, gather'd from the 9. of *June* till the ſummer ſolſtice, with other bigger *cocci*.	III. The larger ſpherical grain, the *coccus* of the bigneſs of a vetch, or as big as that of white pepper, which is gathered from the middle of *June* till about the middle of *July*.
IV. The leſſer worm with 6 feet, no wings: It comes out of the abovementioned *coccus*, from the ſummer ſol-	IV. The larger worm with 6 feet and no wings; that is, the female coming out in the beginning of *July*; but ſtice

ſtice till the middle of *July*.

V. The *nympha* which appears about the beginning of *July* and the following days.

VI. The fly, the male, coming out from the middle of *July* till the 24. of the ſame month, which impregnates the female worm marked N° IV.

chiefly about the middle of the ſaid month; which being impregnated by the male N° VI. brings forth the egg N° I.

This inſect under what ſhape ſoever it appears, whether of a grain, a male worm, a *nympha*, a fly, a female worm, or a worm coming out of an egg; when preſs'd and cruſh'd does always afford a matter of a purple colour, which however is obſerved to run moſt copiouſly in the *cocci* and the worms, eſpecially the female ones,

A farther Explanation of the Uſe of the Bile *in the Animal* Oeconomy; *by Dr.* Alexander Stuart. Phil. Tranſ. N° 427. p. 5.

IN the ſhort eſſay on the uſe of the bile in the animal œconomy in *Phil. Tranſ.* N° 414. ſome points having been there only hinted at; Dr. *Stuart* thought it neceſſary to ſet theſe in a clearer light, by ſolving ſuch difficulties, and anſwering ſuch remarks, as have occurr'd either in converſation or correſpondence on that ſubject.

The firſt remark which deſerves regard is, that no notice is taken of the effect of the gall ſpilt upon the external coat of the inteſtines from the wound in the gall-bladder, whoſe *ſtimulus* on the outſide is ſuppos'd ſufficient to have produced, and to have ſolv'd all the phenomena, or ſymptoms obſerv'd and related in the caſe: So that all the ſymptoms, attributed to a want of the *ſtimulus* of the gall on the inſide of the inteſtines, might have been more properly aſcribed to the ſame *ſtimulus*, acting upon the outſide of the uppermoſt guts, ſituated next the gall-bladder, whoſe compleat contraction by the force of that *ſtimulus* expelling the air out of their cavity, and forcing it into the lower guts (as in windy colics) would have diſtended them

to

to the pitch, mention'd in that eſſay. At the ſame time it is acknowledged, that had the gall been carried clean out of the body by any vent; ſo as that no *ſtimulus* had remain'd to act either upon the inſide or outſide of the inteſtines, then the Dr's way of accounting for the ſymptoms had been good, and the concluſions juſt.

The Dr. acknowledges, that there is ſome appearance of reaſon for this remark, and the objection it implies: But the whole ſtrength of the argument according to the Dr. lies in a ſuppoſition that a *ſtimulus* on the outſide of the inteſtines is capable of exciting a contraction, ſupplying the want of that *ſtimulus* on the inſide, and likewiſe of cauſing a preternatural diſtenſion of the whole inteſtinal canal: The contrary of all which the Dr. endeavours to prove.

And in order to this he thinks it neceſſary to premiſe what, perhaps, may not have been univerſally adverted to, yet can be no ſooner propos'd than acknowledged 1. That the whole action of the nerves, whether in ſenſation, or muſcular motion, is exerted at their extremities only. 2. That the ſides of the nerves every where along their whole tracts are entirely inſenſible, and ſerve neither for ſenſation nor motion.

The *apparatus* of nature towards both theſe actions makes this plain. Towards ſenſation we ſee, that the medullary ſubſtance of the nerves at their extremities is diveſted of its coverings, which are proceſſes of the *dura* and *pia mater*, and ends bare in the form of ſmall ſoft *papillæ*, which from their figure anatomiſts call *pyramidales*, on the ſurface of the *cutis*, covered over with the *cuticula*, where they act their part in ſenſation, or in feeling, taſting and ſmelling. The ſoft denudated branches of the optic nerve which compoſe the *retina*, and what for the ſame reaſon is call'd the *portio mollis* of the auditory nerve, the immediate inſtruments of ſeeing and hearing, prove the ſame. Again, it is the extremities of the nerves that enter with their coverings into the muſcle, and into each fibre of the muſcle to which they belong; where they depoſit their contents, or act their part in muſcular motion. But the ſides of the nerves along their whole tracts are inſenſible or void of feeling; becauſe their medullary ſubſtance, and its contents, which are the only immediate inſtruments of ſenſation in them, are here cover'd with the *pia* and *dura mater*; the laſt of which is the ſtrongeſt, denſeſt, and moſt unpenetrable membrane of the whole body, capable of defending and conveying the tender medullary ſubſtance of the nerves and its contents,

ſafe,

ſafe, unhurt and undiſſipated to the ſeveral organs of ſenſation and motion, at their extremities, the ſeats of their action.

A farther confirmation of this from experience is the inſenſibility of the ſide of a large viſible branch of a nerve, which ſometimes happens to lie bare and expos'd in a wound or ulcer, where it will bear the touch of the probe without feeling, and occaſion no more pain than in wounds and ulcers of the ſame kind, where the nerves are not expos'd, unleſs the inveſting membranes, *viz.* the *dura* and *pia mater* be by any accident wounded, lacerated or corroded: In which caſe, the medullary ſubſtance being laid bare, exquiſite pain is felt, and very ſevere ſymptoms enſue, which are hardly to be conquered, or never ſo eaſily as by cutting the nerve quite thro; ſo as that the extremity may retire within the fleſh, and the medullary ſubſtance be defended by it. By which it appears, that the ſides of the nerves are inſenſible; and that the extremity of the medullary ſubſtance laid bare, either by nature, or by ſome accident, is the only immediate inſtrument of ſenſation. This being premis'd, the ſtructure of the inteſtines, the parts in queſtion in the caſe before us, comes to be conſider'd.

The inteſtines are made up of 4 tunics or coats; the firſt or external coat is a common membranous covering from the *peritonæum.* The 2d. is compos'd of annular, contractile, muſcular fibres, the immediate inſtruments of their periſtaltic motion. The 3d. is the nervous coat, a reticular *plexus* of nerves, intermix'd with blood veſſels and glands, placed immediately under the muſcular, and over the villous coat. The 4th. is the villous or innermoſt coat on the concave ſide; rightly call'd villous, as it appears thro' a microſcope: Tho' from its appearance to the naked eye, it be erroneouſly called the mucous coat. This is generally allowed to conſiſt of the capillary extremities, or rather roots of the lacteals, and the excretory ducts of the glands, which together form theſe *villi* obſerved in it. Among theſe, in analogy to all other parts of the body, the *papillæ pyramidales,* or extremities of the nerves, are lodged under the *cuticula* of the nervous coat, for the uſes of ſenſation, ſo neceſſary for the purpoſes of nature, in this very ſenſible part the inſide of the guts, which is known to be ſo quickly and neceſſarily affected by the qualities of their contents.

The proper nerves of the firſt or outer coat are thoſe of the *peritonæum,* of which it is a part, ariſing from the *medulla ſpinalis* of the loins and *os ſacrum:* Whereas the nerves proper to the guts are from the *par vagum* and meſenteric *plexus:* As, there-

therefore, there is no communication of nerves between this external coat or covering, and the proper ſubſtance of the inteſtines themſelves; a *ſtimulus*, acting upon this external coat only, would not affect the guts, ſo as to excite any conſiderable degree, either of ſenſation or motion in them.

Again the proper nerves of the inteſtines, whoſe origin, diſpoſition, and ſituation, have been already deſcrib'd, terminate either in the muſcular contractile fibres of the coat immediately above them, or carry their extremities to the inſide, where they terminate under the *cuticula* for the uſe of ſenſation: So that a *ſtimulus* on the outſide of the inteſtines, beſides the difficulty of paſſing thro' the external coats, before it could reach the proper nerves of the guts, would at laſt only irritate their ſides, where they are inſenſible, becauſe cover'd with the *dura mater*: And if it might be ſuppos'd that ſuch a *ſtimulus* as is in queſtion, to wit, the gall, could have penetrated thro' theſe coats into the cavity, where the ſenſible extremities of the proper nerves of the guts lie expos'd to it; yet ſuch a filtration thro' all theſe coats, as it could not be performed ſoon, nor in great quantity; ſo it would enter at laſt, diveſted in a great meaſure of its groſſer, ſaline, oleaginous and pungent parts, by the filtration, and thereby loſe the power of a *ſtimulus* on the inſide; as the ſituation of the parts, and diſpoſition of the nerves above deſcrib'd, made it an ineffectual one on the outſide, as much as if it had been carried quite out of the body. To conclude, if the gall, ſpilt on the outſide of the guts, had been capable of exciting a contraction in any part of them; ſo ſoon as it came to cover the whole ſurface, it muſt have had the ſame effect equally every where, and the whole canal ſhould have been found contracted to its ſmalleſt diameter: Whereas it was found every where diſtended to a great pitch. It is, therefore, plain that a *ſtimulus* on the outſide of the inteſtines has not the effect of ſuch a *ſtimulus* on the inſide: It can neither excite them to a contraction, promote their periſtaltic motion, nor ſupply the defect or want of ſuch a *ſtimulus* on the inſide, much leſs occaſion ſuch an univerſal diſtenſion, or account for the ſymptoms ariſing from it, which is what the Dr. undertook to prove. It was for theſe reaſons, and to avoid prolixity, that the gall ſpilt on the outſide of the inteſtines was not taken notice of in *Phil. Tranſ.* N° 414.

The ſecond difficulty is how a freſh recruit of chyle ſhould be a cauſe of ſleep.

The experiments made in *Phil. Tranſ.* N° 424, he hopes may ſerve to juſtify what he here aſſumes, concerning the nature and exiſtence of the nervous fluid, or animal ſpirits, in the ſolution of this ſecond difficulty.

The argument runs thus: It is well known that people after a plentiful meal are often inclin'd to ſleep, long before the chyle can be ſuppoſed to be got into the blood: Therefore, a freſh recruit of chyle cannot be the cauſe of ſleep; but there muſt be ſome other cauſe, at leaſt at that time: Which cauſe is aſſigned by ſuppoſing, that after a plentiful meal the diſtended ſtomach will load and oppreſs the deſcending *aorta*; ſo as to hinder the blood in its deſcent; and thereby force a greater quantity than uſual into the aſcending *aorta*, which by its diſtended branches in the brain, will obſtruct the ſecretion of the animal ſpirits thro' the glands of the cortical ſubſtance into the origin of the nerves, and thereby produce ſleep. This being generally eſteemed a mechanical account of the cauſe of ſleep after meals, deſerves the greater attention.

In anſwer to which; if ſuch were the true cauſe of ſleep after meals, it ought to have the ſame effect upon the *cerebellum*; from whence moſt of the nerves, that ſerve in the natural and vital functions, ariſe; and ſo it would hinder theſe functions, to wit, digeſtion, the periſtaltic motion, reſpiration, and the circulation of the blood; all which, on the contrary, are obſerv'd to be ſtronger and more regular in ſleep than when we are awake, at leaſt in a healthy and temperate perſon, who has us'd moderate exerciſe. Again, gluttony, drunkenneſs and *flatus*'s, which overload the ſtomach; and therefore, according to this hypotheſis, ought to produce the quieteſt and moſt ſerene repoſe in ſleep, do, on the contrary, bring inquietude, or broken and interrupted reſt; and when, to the greateſt exceſs, a lethargic ſleep, which is a diſeaſe for the time, and ſometimes terminates in death. In like manner the *incubus*, which is juſtly ſuppos'd to ariſe from an inflation or diſtenſion of the ſtomach in a ſupine poſture in bed, oppreſſing the deſcending *aorta*, ought to produce quiet reſt: Whereas nothing diſturbs more; as it firſt brings the perſon out of quiet ſleep into a ſort of waking dream, with a ſenſe of oppreſſion, and at laſt wakes him quite in a kind of terror, with a palpitation of the heart. And indeed as nothing contributes more to ſound and quiet reſt than an eaſy digeſtion and reſpiration, a ſedate, equal nd regular circulation of the blood; that is, an uninterupted exercise of all the natural and vital parts; the reverse of these, and particularly an interrupted or difficult circulation, if to any considerable pitch, must produce the contrary effects, to wit, some degree of restlessness or inquietude; as in fevers and other distempers attended with such irregularities of the animal oeconomy.

The difficulty suggested about the chyle's not getting soon enough into the blood, by the way of the lacteals, to produce this effect in such as sleep immediately after a plentiful meal, vanisheth when we consider, that this very rarely happens, at least never attends temperate people, in perfect health, and in a temperate climate; but such as are gross feeders, drunkards, corpulent, short-neck'd, by constitution, or make, liable to apoplexy or palsy, or have formerly suffer'd by such distempers, or live in a hot country.

In gross feeders, drunkards, and such as are corpulent, from these causes the lacteals are never quite empty: In such the food of the present meal, by exciting the peristaltic motion, will, in a few minutes, press forward the chyle of the preceeding meal into the blood. In full vessels or tubes the reception and discharge will be instantaneous, or nearly such; because, supposing the apertures to be free, or unobstructed, as much precisely will issue at one extremity of a full vessel or tube, as is forced into it at the opposite extremity, and that instantaneously; because of the contiguity of the globules, or particles of the fluid it contains. In short-neck'd people the passage between the heart and the brain being proportionably short, the force or *momentum* of the circulation in the brain is by so much the greater; but a strong and swift circulation is an enemy to all secretions, as is evident in fevers, and mechanically demonstrable: For, all the secretions being by lateral branches going off at or near to right angles (which is very remarkable in the brain) a swift circulation or motion along or parallel to the axis carries along with it what should be laterally secerned: Hence a paucity of animal spirits in short-necked people, who by this make are liable to apoplexies, palsies, coma's, lethargies, a listlessness, inactivity and drowsiness, especially after meals, when the fresh chyle has got admission, to absorb a part of the already few remaining spirits, which must be recruited in sleep. Again in hot climates; a continual waste or dissipation of the spirits by heat, makes the inhabitants

 generally

generally lazy and unactive: In ſuch the recent chyle, the groſſeſt circulating fluid of the whole body, will quickly abſorb the few remaining ſpirits, and diſpoſe them to ſleep after every meal; except when the cool of the evening checks perſpiration, and the evaporation of theſe ſpirits, which were recruited by ſleep in the day time; and therefore remain plentiful enough to ſupport their activity after ſupper, when the buſineſs of the meaner, and diverſions of the richer ſort begin; which, in colder climates, is the caſe after breakfaſt and dinner. For a farther confirmation of this, brandy and the ſpirits of fermented liquors, are known to produce a drowſy ſtupidity in ſuch as drink them to any pitch, and an habitual dullneſs in habitual drinkers of them; and when drank to exceſs, they throw into a kind of lethargic ſleep for ſome time: Yet the quantity taken down, ſufficient to produce theſe effects, is never ſo much as to load or diſtend the ſtomach in ſuch a manner as to oppreſs the deſcending *aorta*, or hinder the circulation downwards; and therefore, cannot be ſuppos'd to produce ſleep or ſleepineſs in that manner, but in a different way, as ſhall be deſcrib'd in the ſequel of this diſcourſe.

Thus, what has been generally eſteemed a mechanical cauſe of ſleep after meals, being, the Dr. thinks, ſufficiently refuted, it remains to eſtabliſh ſuch a general cauſe of ſleep, as may be conformable to what is advanc'd in the eſſay under conſideration.

He believes it will hardly be denied, that the cauſe of ſleep in general is a want of a ſufficient quantity of animal ſpirits, for the uſe and exerciſe of the animal functions: Whatever, therefore, prevents their recruit, hinders or impedes their ſecretion, abſorbs or fetters them when produced; and whatever exhauſts or evaporates them, by occaſioning a paucity of ſpirits, will, in a healthy perſon, produce a liſtleſſneſs, lazineſs, a tendency to ſleep, or ſleep itſelf, in proportion to that paucity of the remaining ſpirits. If we enumerate all the known remote cauſes of ſleep or ſleepineſs, we ſhall find that in ſome one or other of the ways above ſet down, they do all of them tend to produce this immediate or proximate cauſe, to wit, an impairing of the nervous fluid, or animal ſpirits, and thereby bring on theſe ſeveral diſpoſitions to ſleep, or ſleep itſelf.

All the remote cauſes of ſleep or ſleepineſs may, the Dr. thinks, be fully comprehended in the four following particulars,

culars, and confidered in the following order. 1. Exercife. 2. A too plentiful meal. 3. Drunkennefs, or a too great quantity of fermented liquors, or of their diftill'd fpirits. 4. The whole tribe of narcotics, foporifics; of which *opium*, and its feveral preparations, are the chief.

1. Exercife appears to wafte all the fluids, and particularly the animal fpirits, the active inftruments of all motion: So that the remains are not fufficient for the exigencies of the natural and vital functions, nor to fupply the demands of voluntary motion, nor affift in fenfation, and the operations of the mind. And here it is proper to fhew how this wafte neceffarily brings on fleep in a healthy perfon; and how the natural and vital motions and functions of digeftion, circulation and refpiration, notwithftanding this wafte, do neceffarily go on in fleep, leading the remains of the fpirits to their affiftance, and making the deficiency fall to the fhare of the animal or voluntary motions and organs of fenfation. In order to fhew this, let us obferve what is very obvious; namely that when any mufcle is brought into action againft our will by a fuperior force, as when a ftronger man bends or extends one's arm contrary to his will or inclination; the benders or *extenfores* of the arm fwell and contract in the fame manner, and the afflux of the blood and fpirits to the contracting mufcles, is the fame, as when it is done voluntarily: Therefore, by any external or adventitious force, the blood and fpirits will be derived upon the part thus forced into action: But all the natural and vital parts have fuch an external or adventitious force continually acting upon them. In the *primæ viæ* the weight and other qualities of our food and drink, mix'd with air and bile, excite the periftaltic motion, as neceffarily as the weight of a clock, or fpring of a watch, wound up, keeps the wheels and pendulum, &c. in motion. The chyle forced from thence, and the blood returning into the heart, neceffarily fet its elaftic fprings at work, and the fame blood and chyle forced into the arteries by it, make their *diaftole* and following *fyftole* inavoidable. The air by its elafticity, and the whole weight of the atmofphere, forceth itfelf into the elaftic pipes and veficles of the lungs, and dilates them; which by their elafticity and mechanifm, affifted by various mufcles, and the ribs and cartilages of the *thorax*, as neceffarily repel it in expiration. It is, therefore, evident, that all thefe natural and vital parts are acted upon, and fet at work by an external adventitious and irrefiftible force, continually

tinually exciting them, whether we will or not, whether awake or asleep; the blood, therefore, and remaining spirits after labour, will be mechanically and necessarily led to all these parts that are thus forced into action at all times; but especially, most regularly and copiously in sleep, when all external objects ceaſe to sollicit our senses, and the will does no longer determine the spirits into the muscles of voluntary motion; which two kinds of action, as well as the operations and passions of our mind, do, in the day-time, make strong derivations of the spirits from the natural and vital functions; which, for that reason, are never so perfect as in sound and undisturbed sleep.

Those, who are acquainted with the doctrine of derivations and revulsions, founded upon innumerable observations in the animal oeconomy and practice of physick, do know, that a flux of any of the animal fluids arising from nature, or from a disease, or excited by art towards any one or more parts of the body, or towards any organ of secretion or excretion, will cause a sensible proportional diminution of the afflux to, and of the secretion and excretion by the other parts and organs: So soon, therefore, as a deficiency of animal spirits happens by labour, or from any other cause whatever, that defect will be first felt in the organs of sensation, the muscles of voluntary motion, and the operations of the mind; because these are not acted upon by such powerful and irresistible agents, as the organs of the natural and vital functions are in perfect health: For, the mind, being sensible of the defect of spirits for its actions and operations, chooseth to forbear; we retire from external objects; and then the whole of the remaining spirits are led to the natural and vital organs, by the mechanism above described; and the organs of sensation and voluntary motion must be entirely deserted by them for that time; which is the state of sleep, and which will continue, till a greater quantity of spirits be recruited than is consumed in the natural and vital functions; at which time the redundancy or overplus begins again to be secerned into the other deserted nerves, to wit, into those of sensation and voluntary motion; which flowing now copiously into the relaxed muscles, excites stretching, yawning, &c. and at last rouzeth out of sleep.

2. A too plentiful meal is known to cause a heaviness, inactivity, listlessness, an aversion to motion or action, a drowsiness, sleepiness, and in some sleep itself, soon after eating. It has been prov'd above that this cannot proceed from

from a diſtenſion of the ſtomach; and that in ſuch the lacteals are never empty; and that the chyle of the preceeding meal is forced thro' them into the blood by the ſucceeding, almoſt inſtantaneouſly, or ſo ſoon as the periſtaltic motion is excited or increas'd by the food taken down, which muſt be during the time of ſuch a meal, or very ſoon after, according to the degree of fullneſs of the lacteals before that meal. What change then can we imagine to have happen'd to the body in this time of a meal, ſo remarkable, and ſo likely to affect the oeconomy, as that of the admiſſion of a fluid into the blood, much groſſer and leſs fluid than itſelf? Such a mixture muſt render the whole maſs groſſer, or of a thicker conſiſtence than before, as it quickly mixeth with the finer, and abſorbs its moſt fluid parts; but it will hardly be denied, that if there be ſuch a fluid as animal ſpirits, they muſt be the fineſt and moſt depurated fluid of the blood: Theſe, therefore, will be abſorbed and mix'd with this groſſer crude fluid, the chyle; and therefore will be diminiſh'd by it; and being thus entangled, will be more difficultly ſecreted, and in leſs quantity: Hence that paucity of ſpirits, which will diſpoſe to ſleep in the ſame manner as after labour or exerciſe.

3. How far ſtrong fermented vegetable juices, or liquors, and their diſtill'd liquors, drank to any pitch of exceſs, bring on ſleep, or ſome degrees of it, has already been ſaid. The diſtill'd ſpirits of fermented liquors are known to leſſen all the ſecretions and excretions; and therefore are of uſe in *diarrhœa*'s, in exceſſive and colliquative ſweatings; and the Dr. has known *French* brandy, taken incautiouſly, to have put a ſtop to a ſweat procur'd by ſudorifics. In habitual drinkers of them, they gradually leſſen the ſecretion of the bile, and inſenſible perſpiration; and thereby bring them at laſt into the jaundice and dropſy. Spirituous liquors, and particularly *French* brandy in the moſt remarkable manner, being mix'd with the blood, as it flows from a vein into a poringer, unites the ſerous with the globular red part of the blood, to ſuch a degree, as that no *ſerum* ſeparates from it in ſeveral hours, and in ſome not at all: Which ſhews in what manner it hinders the ſecretions in the body; theſe being all of them of the ſerous kind: Hence that great impurity of the blood ariſing from a reſtraint of the ſecretions in ſuch people; and alſo that paucity of ſpirits, the general cauſe of ſleep and dullneſs, very different from the alacrity and vivacity of the temperate, and even of water-drinkers.

That

That, therefore, which fetters or binds up all the serosities, or most fluid parts of the blood, and proves a strong *copula* between them and the red globules thereof, may be reasonably suppos'd to fetter or tie up the finest fluid of all, to wit, the animal spirits with the rest, and in the same manner to hinder their secretion, and thereby produce sleep, or some such degree of it as is above-mentioned.

4. As to *opium*, and all the class of soporifics, if we compare the visible effects of them with what has been said above of brandy, or spirits of fermented liquors, we shall find them much the same. *Opium* is known to lessen or suppress all the secretions and excretions; and is, therefore, of such remarkable use in fluxes, rheums, catarrhs, *&c.* It has indeed been taken for a sudorific, but that only in composition with aromatics, as in *Venice* or *London* treacle; or with saline bodies, as the *sapo tartareus* in the *Pill. Matthæi* or *Starkii*, and that two assisted by plentiful dilution with warm sack-whey, or such like liquors, and the addition of volatile spirits of hartshorn, *&c.* which are known to thin the blood, as M. *Leewenhoeck*'s microscopical observations, and the mixing of these volatile saline spirits with blood, as it runs out of the vein into a porringer, do sufficiently evince: Which shews that these volatile salts are good correctors of *opium*, as they break down and colliquate the blood: and therefore tend to promote the serous secretions, which *opium* by itself, and all distill'd spirits of fermented liquors do retain or restrain for some time, incorporating the serosities with the red globules of the blood, as has been observ'd before. In hot countries, where large doses of *opium* are taken, the effects are nearly the same with what we observe in drinkers of distill'd spirits of fermented liquors; to wit, a small dose exhilerates, a larger brings on some degree of drunkenness, or temporary madness; and this increas'd will lay to sleep, and a very large dose will kill. In this comparison, therefore, may we not justly conclude a parity in the causes, from the similitude of the effects, tho' all the secundary qualities of such causes which offer themselves externally to our senses, be apparently very different: Thus gun-powder is as much a latent fire as brandy, and will exert itself in that shape to a far greater degree than it in equal circumstances, that is, by the least contact of fire; and therefore, tho' brandy and *opium* shew no outward resemblance to our senses in smell, taste, colour, consistence and

and ſuch like ſecundary qualities, no more than brandy and gun-powder: yet if in proper and equal circumſtances, that is, in contact and mixture with the blood, they produce the ſame, or nearly the ſame, effects, we may juſtly conclude, that there is a latent ſimilitude of primary qualities in their natures, which they manifeſt in proper and equal circumſtances, in producing the ſame or parallel effects. But it has been above ſhewn how, and in what manner, brandy fetters and intangles the animal ſpirits, and other fluids of the blood; uniting them too intimately with the groſſer parts, and thereby hindering their due ſecretion for ſome time: Whence a paucity of ſpirits, which diſcovers itſelf by an inequality and irregularity of their diſtribution in drunkenneſs, a ſtill greater effect in dullneſs and drowſineſs; ſtill more in ſleep, and a total ſuppreſſion of their ſecretion, as well to the natural and vital, as to the animal organs, which is death, the effect of the greateſt doſes either of ſuch diſtill'd ſpirits, or of *opium*.

From what has been ſaid on this ſubject, it ſeems as plain as the nature of ſuch a phyſical demonſtration will admit of. 1. That the univerſal cauſe of ſleep is a paucity of animal ſpirits. 2. That this defect will ariſe from whatever exhauſts, waſtes or evaporates them when produced, as labour and exerciſe; or from whatever abſorbs them, as a great quantity of crude chyle, recently and ſuddenly admitted into the blood, in the time of, or ſoon after, a plentiful meal; or whatever can fetter or re-unite them with the groſſer parts of the blood, as much as brandy, or ſpirituous fermented liquors, and opiates. All theſe, either by evaporating or waſting them, or by hindering their production or ſecretion, do bring on that paucity of ſpirits ſpoken of, and ſleep, or ſome degree of ſleepineſs, as a neceſſary conſequence. Yet it will be ſtill true upon the ſame foot of reaſoning, that where the blood is exceedingly depurated, and the ſecretions and excretions from it already perfectly performed, as in long faſting, the whole maſs of blood is become only fit for the ſecretion of ſpirits; has no crudity or impurity in it to abſorb or fetter the ſpirits already produced; and no crude chyle admitted to anſwer that end. In ſuch a caſe opiates can have no effect, the ſpirits cannot be abſorbed, fetter'd, or reſtrain'd, where the qualities of the maſs of blood do *not* concur to produce that effect. Another concurring cauſe of the inefficacy of opiates in the caſe of faſting is, that all the natural parts, thoſe, to wit, of the *primæ viæ*,

viæ, which ſerve for digeſtion, are at reſt, for want of the weight and *ſtimulus* of food, and likewiſe of the gall in the caſe referr'd to, to keep up their periſtaltic motion: Therefore few or none of the ſpirits being ſpent on thoſe parts, there is a greater ſupply ſent to the animal organs of ſenſation and voluntary motion; and indeed in ſuch a caſe, even the vital parts for reſpiration and circulation do act but very ſluggiſhly, for want of a recruit of blood and fluids, proper to excite their functions: Hence alſo the ſupply of ſpirits to the organs of ſenſation and voluntary motion, is by ſo much the greater; and the poſſibility of reſtraining the ſecretion, for the reaſons above-aſſigned, impracticable by any power of *opium*, without the acceſſion of a freſh recruit of chyle. Hence alſo thoſe who have any conſiderable defect in the natural and vital functions, or in either of them, by obſtructions of the *viſcera*, are generally bad ſleepers, or watchful; and in ſuch, opiates have but little effect to procure reſt, with this great diſadvantage, that by impeding the ſecretions, they increaſe the obſtructions; tho' in many caſes, where the *viſcera* are ſound, they muſt be acknowledged to be excellent medicines. What has been ſaid will alſo ſufficiently account for the anodyne power of *opium*: For, if it impede the ſecretion of the animal ſpirits, the immediate active inſtruments of all ſenſation, it muſt certainly obtund or aboliſh for that time the diſagreeable ſenſation of pain. 3. The third difficulty is, how *pus* ſhould be the product of chyle, and not of the blood or *ſerum*. As to which, it would not, the Dr. thinks, be difficult to prove, that all the groſs ſecretions are from the chyle; theſe being only the depurations of it in ſanguification, or in order to bring that crude and groſs fluid the chyle into pure and defecated blood; from which no ſecretion can afterwards be made, but of that pureſt fluid, which it ſecretes into the nerves for the uſe of the whole oeconomy. If this be true, then *pus* in a wound, ulcer, or impoſthume, being a very groſs feculent humour, is likelier to iſſue from the chyle, than from the purer or more defecated part of the maſs.

Of

Of the flying Squirrel, *or* Mus Ponticus *or* Scythicus *of* Gesner, *and of the* Vespertilio admirabilis Bontii: *by M.* Klein. Phil. Transf. N° 427. p. 32. *Translated from the* Latin.

THAT a thousand idle stories about winged and flying animals, as dragons, basiliscs, griffins, &c. have crept into natural history, no one, who without prejudice and a vulgar credulity has thoroughly considered the matter, can deny: The celebrated M. *Scheuchzer* in *Jobi physicâ sacrâ* p. 257. *seq.* as also *Hyacinthus Gimma* in his second *Physico historico experiment. dissert. de fabulosis animalibus* have endeavour'd to confute these fabulous relations. But as to flying quadrupeds in particular, experience shews, that there are some such; as common batts, which may be call'd creeping, if not walking quadrupeds, *vide Gesner de avibus* p. 695. Besides these, there is a peculiar kind of flying lizzard, under the name of *lacertus volans* or *dracunculus alatus*, very common in *Java*. *Belonius*, it is true, represents it a *Biped*, but this is deservedly contradicted by *Piso* and others: And indeed the *dracunculi*, preserv'd in several *musæum's*, do abundantly confirm their being quadrupeds. Such quadrupeds are properly call'd *flying*, as do really fly, that is, roam about freely in the air: But such are improperly said to fly, as generally live in trees, as the common squirrels, and other animals of this kind, martens, &c. nay, many others that by leaping from one tree to another seem to fly.

Amongst these the principal is the flying squirrel, so call'd, as it is provided with a kind of sail, or peculiar flying instrument. M. *Klein* finds one of them in *Levinus Vincentius*'s *Catal. & Descript. Animal.* 1726. p. 8. *Centur.* 1. N° 92. under the name of *Sciurus Virginiensis volans*, without any farther description of it: And a certain friend told M. *Klein*, that Mr. ——— of *London* had a *Sciurus Virginiensis*, that slept all winter, and would not wake unless something warm was applied to it, and then it would move one or both feet, till being quite awake, it would again seem to live. He finds another of them in *Grew*'s *Musæum* of the *Royal Society*, under the name of *flying squirrel*, which Dr. *Grew* takes to be the animal *Scaliger* in *Exercit.* 217. §. 9. describes under the name of *felis volans*. *Lawson* in his history of *Carolina* exhibits a third. And in fine, *Gesner de quadruped.* p. 743. a fourth, which he calls *Mus ponticus* or *scythicus*, or *sciurus* *volans & alatus:* He himſelf had not ſeen the animal, but only its expanded ſkin, which he likewiſe caus'd delineate; ſome account of this laſt M. *Klein* gives as follows: *March* 19. 1727, two of theſe *ſciuri volantes* were brought alive to *Warſaw*, and preſented to *Auguſtus* II. King of *Poland*, both which *Magnificus â Heucher*, King's counſellor and phyſician obſerv'd; and he examin'd one of them dead, and caus'd delineate its expanded body, as alſo its ſkeleton, as repreſented Fig. 2. 3. Plate XI. In ſummer 1728 the Princeſs *Radzivil* ſent M. *Klein* a live ſquirrel, it was taken in the woods of *Kriczovia*, in the diſtrict of *Mobilovia*, on the confines of *Ruſſia*. The people of *Mobilovia* affirm that theſe animals live in hollow oaks, and roll themſelves up in the moſs of the birch, where they ſleep all day, and go in queſt of their food in the night. Hence it happens, that they are taken in the following manner: The huntſmen fix nets to the hole of the tree, and make a fire round the root; and as ſoon as the ſmoke enters the hollow of the tree, the ſquirrels immediately quit their retreat, and being entangled in the nets, fall to the ground, and ſo are taken.

Fig. 1. Plate XI. repreſents the bigneſs of the one M. *Klein* had. It is, therefore, leſs than the common ſquirrel, and bigger than the field mouſe; its ſkin is very ſoft, elegantly adorned with grey and dark grey pile; it has large, prominent, black and very beautiful eyes; ſmall ears and very ſharp teeth with which it gnaws very fine; moſt of them are miſchievous; but this M. *Klein* had was pretty mild; it would not catch at the finger, tho' put to its mouth; but there was no truſting it if provok'd. When it does not leap, its tail (which is an agreeable ſight) lies cloſe to its back: but when it does it hangs it down, wagging it from ſide to ſide. It eats bread baked without ſalt, and the freſh tops of birch are its favourite food; it neither cares for nuts nor almonds; it makes its bed in an elegant manner of the moſs of the birch, and with ſurpriſing facility drawing it with its feet, it lies buried therein, as it were: and does not ſtir from thence in the day-time unleſs diſturb'd, or preſs'd with thirſt. As to its flying inſtrument; the ſkin may be expanded from its ſides like a ſail for the breadth of a palm nearly; it adheres to the bending of the hinder feet, but is connected to a bony articulation with the fore feet; at the extremity of this articulation the ſkin is downy: When it ſits quiet, or moves with its natural pace, this articulation, which is parallel with its feet

[illegible]

[illegible] the people [illegible]

[illegible] which.

[illegible]

G. Smith del.

Hulett Sculp.

feet, cannot be diſtinguiſh'd; but as ſoon as it leaps, it is moved, and forms a right angle, as it were, with the fore-foot; whence the ſkin, as has been ſaid before, is expanded, tho' likewiſe a ſtrong *panniculus carnoſus*, that paſſes under the whole ſkin, does much aſſiſt its leaping. From this M. *Klein* gathers, that this little animal does not properly fly, but that it can leap to places at ſome diſtance, with greater eaſe than other animals of the ſame kind, and by means of its ſails continue longer in the air. With this flying ſquirrel compare the *Veſpertilio admirabilis Bontii* in *Hiſt. Nat. & Med. Ind. Orient. cap* 16. *Apud Piſon. p.* 68. *Piſo* himſelf would doubt, whether it is to be claſs'd among the family of batts, 'becauſe, *ſays he*, it is as big as a cat, 'its belly and breaſt thick and carnous, and down from the 'neck to the extremity of the claws is a continued membrane, 'almoſt like an expanded ſail; add, that this ſail on the 'under ſide is membranaceous, cover'd with down, veins and 'fibres; but on the upper ſide cover'd all over in a ſurpri-'ſing manner, with very ſoft pile, like that of a rabbit, of a 'grey and dark grey colour; and that it has no *plicæ*, as the 'wings of other animals have, either to contract or dilate it; 'and that it is almoſt three foot in length, and of the ſame 'breadth.'

As to what *Bontius* aſſerts, namely, *that this kind of* veſpertiliones admirabiles *flie in flocks, like wild geeſe*, M. *Klein* could not perſuade himſelf, on duely conſidering the bulk of this animal and its ſtructure; but he rather thinks, that ſuch animals come nearer to the nature of flying ſquirrels, and that they uſe their ſails in the ſame manner; notwithſtanding what *Bontius* aſſerts, that *about the evening they are obſerv'd pendulous in the air, or from trees*; but that rather it may hence be proved, that theſe *veſpertiliones*, as well as the flying ſquirrels, ſleep in the day time, and about the evening quit their retreats, leap from one tree to another; and therefore, that when they leap they are obſerv'd to be pendulous in the air; but when they have done leaping, they are found to hang from trees. Beſides, theſe *veſpertiliones admirabiles* may be called *feles volantes*, with equal propriety, as *Geſner* call'd the *ſciuri* here ſpoken of, *volantes*. In fine it is to be obſerv'd, that what *Geſner* relates from *Vincentius Beluacenſis* and *Olaus Magnus* is real matter of fact, namely, that the common ſquirrels when they have a mind to croſs any water, put a piece of ſome very light wood upon

upon it, and ſitting thereon, ſteer with their tail (yet not erect, as *Geſner* would have it, but continually moving, and not when the wind blows, but when it is calm) and croſs over, as was obſerv'd more than once at the iſlands of *Gothland.*

A Deſcription of a Barometer, *wherein the Scale of Variation may be increas'd at Pleaſure; by Mr.* John Rowning. Phil. Tranſ. N° 427. p. 39.

ABCD (Fig. 4. Plate XI.) repreſents a cylindrical veſſel, filled with a fluid to the height W, in which is immerged the barometer S V, conſiſting of the following parts; the chief of which is the glaſs-tube TP (repreſented ſeparately at *tp)* whoſe upper end T is hermetically ſeal'd. This end does not appear to the eye, being receiv'd by the lower end of a tin pipe GH, which in its other end G receives a cylindrical rod, or tube ST, either hollow or ſolid, made of any materials whatſoever, thereby fixing it to the tube TP. The rod ST may be taken off, in order to put in its ſtead a larger or leſſer, as occaſion requires; S is a ſtar at the top of the rod ST, which ſerves as an index, pointing to the graduated ſcale LA, which is fixed to the cover of the veſſel ABCD; MN is a large cylindrical tube made of tin (repreſented ſeparately at *mn)* which receives in its cavity the ſmaller part of the tube TP, and is well cemented to it at both ends: ſo that none of the fluid can get in. The tube TP, with this apparatus, being filled with mercury, and plunged into the baſon V, which hangs upon two or more wires upon the lower end of the tube MN, muſt be poiſed in ſuch a manner, as to float in the liquor contain'd in the veſſel ABCD, and then it will riſe when the atmoſphere becomes lighter, and *è contra.* Let the ſpecific gravity of quickſilver be to that of water, or to the liquor the barometer floats in, as s to 1; and if it be propoſed, that the variations of this compound barometer ſhall be to the contemporary variations of the common barometer in the given ratio of n to 1; this effect will be obtain'd by making the diameter of the rod ST to the diameter of the cavity of the tube HI, as $\sqrt{\frac{n+s}{ns}}$ is to 1; which may be thus demonſtrated.

Let us ſuppoſe that the variation of the height of the quickſilver in the common barometer, call'd v, is ſuch, that a cubic inch of quickſilver ſhall riſe into the *vacuum* XT; in order

order to which a cubic inch of quickſilver muſt riſe from the veſſel V, that is, the ſurface P muſt ſubſide ſo far, that a cubic inch of water (if that be the fluid made uſe of) ſhall enter the veſſel V; by which means the barometer with the parts annexed will be heavier by a cubic inch of the fluid. Now this additional weight of a cubic inch of fluid will make the whole barometer ſubſide (according to the laws of hydroſtatics) till a cubic inch of the rod H S, immediately extant above the ſurface at W, ſhall come under it: But the length of ſuch a magnitude of H S will exceed the length of an equal magnitude of quickſilver in the larger tube X, as much as the ſquare of the diameter at X exceeds the ſquare of the diameter at H (the lengths of equal cylinders being reciprocal to their baſes) that is, the perpendicular deſcent of the compound barometer will be to v, the perpendicular aſcent of the mercury in the common barometer, as d to 1 (ſuppoſing this the ratio of the baſes) and conſequently, will be equal to dv. But by this deſcent the diſtance P W between the ſurface of the ſtagnant quickſilver and the top of the fluid will be augmented by a column, whoſe height is dv, the deſcent of the compound barometer; and conſequently, the weight of the whole column of the fluid preſſing on the lower ſurface of the quickſilver (to which the height X is partly owing) will be increas'd by a column of that length, and this increaſe would produce a ſecond aſcent of the mercury at X, equal to itſelf, namely, dv, were the fluid as heavy as quickſilver; but ſince it is ſuppos'd to be lighter in the ratio of s to 1, the aſcent of the mercury on this account will only be $\frac{dv}{s}$. But now, as in the former caſe, when the aſcent of the mercury was v, the deſcent of the compound barometer was ſhown to be dv; ſo here the aſcent of the mercury being $\frac{dv}{s}$; the deſcent of the compound barometer will be $\frac{ddv}{s}$, and the next deſcent $\frac{dddv}{ss}$, and the next $\frac{d^4v}{s^3}$; and ſo on *in infinitum*: Therefore, the whole deſcent of the compound barometer is to the aſcent of the mercury in the common barometer; that is, n is to t, as $d + \frac{dd}{s} + \frac{ddd}{ss} + \frac{d^4}{s^3} +$, &c. to 1; or as $\frac{ds}{s-d}$ to 1;

because

because the terms of the series being in geometrical progression, the sum of them all is $\frac{ds}{s-d}$. Hence we have $n=\frac{ds}{s-d}$; and $ns=ds+dn$; that is, $1:d::n+s:ns::\frac{n+s}{ns}:1$; and $1:\sqrt{d}$; that is, the diameter of S T to the diameter of H I, as $\sqrt{\frac{n+s}{ns}}$ to 1. Q. E. D.

Example 1. Putting $s=14$, and $n=1$; the variations in each barometer will be equal, by taking the diameter of S T to the diameter of H I, as $\sqrt{\frac{15}{14}}:1$; that is, as 30 to 29 nearly.

Ex. 2. If n be put infinite, the diameter of S T will be to the diameter of H I as $\sqrt{\frac{1}{s}}$ to 1; or 1 to $\sqrt{14}$; that is, as 1 to $3\frac{3}{4}$ nearly.

The bottom of the vessel V, and the ends of the tube ought to be made rather round than flat for their more easy motion up and down in the fluid. It will be convenient to have a small bason fixt upon the star to contain shot, for the more easy poising the barometer in the fluid.

Experiments shewn before the Royal Society *with the* Spiritus vini æthereus, *and the* Phosphorus urinæ; *by Dr.* Frobenius. Phil. Trans. N° 428. p. 55.

NOV. 18. 1731, Dr. *Frobenius* took a solution of *phosphorus* in the æthereal spirit of wine, which he called *liquor luminosus*, and pour'd it into a tub of warm water; whereupon it gave a blue flame and smoke, attended with so small a degree of heat, as not to burn the hand, if put into it. He pour'd some of his æthereal spirit of wine upon a tub of cold water, and set it on fire with the point of his sword (with which, being first heated a little, he touch'd a piece of *phosphorus* lodged beforehand on the side of the tub) and after the deflagration the water was cold. He then shew'd a very extraordinary process with *phosphorus glacialis urinæ*, or *stick phosphorus* of M. *Ambrose Godfrey Hanckewitz*. He had a very pompous machine, which he calls *machina Frobeniana pro resolutione combustibilium, inventa anno* 1730. It is really an improvement of the common bell, under which, the *oleum sulphuris per campanam* is commonly prepared. This machine consisted of a concave plate of glass, represented by A B (Fig. 5. Plate XI.) with a hole in the middle C, which communicated by a glass-pipe C D with a glass receiver E E F, which stood underneath the

the plate A B; upon the plate A B ſtood a maſſy golden *tripus*, ſuſtaining a baſon about 4 inches diameter G H, having within it another ſmaller one I K, of the ſame metal, about 2 inches and $\frac{1}{2}$ diameter; this was heated a little: He then took ſmall pieces of *phoſphorus* out of a baſon of water, which he ſoak'd up with brown paper; ſo that the *phoſphorus* might be quite dry, which he put into a ſpoon, and flung it into the ſmaller golden baſon I K, where it immediately took fire: Then he lower'd down a large glaſs bell L M O, of about 18 inches diameter, and containing $\frac{3}{4}$ of a ſphere; the rim L M being exactly ground to fit cloſe on the plate of the glaſs A B: This glaſs bell was ſuſpended by a wooden circle P Q P Q, to which were faſtened 4 cords, that united into one knot at R; and from thence went a rope over a pulley S, in the crown of the machine, and coming down by the ſide of one of the pillars, ſerv'd to raiſe up or let down the bell. At the firſt firing of the *phoſphorus*, the whole bell appear'd luminous, and full of flame for a few minutes: When the deflagration of the firſt ſpoonful was over, he flung in another, and ſo on; till there were 2 ounces of *phoſphorus* conſumed, from which were ſublimed a large quantity of flowers into the bell, and ſome fell down upon the concave glaſs A B. The bell at firſt felt cold, and never grew more than moderately warm. As the flowers began to cover the inſide of the bell to ſome conſiderable thickneſs, the flame was not ſeen thro' ſo brightly as before, but the whole appear'd of a light azure, or ſky colour, which the Dr. *likened to the formation of the firmament*; the flowers ſublimed he *likened to ſnow*: Then the bell being drawn up again, and the golden baſons taken out, there remain'd in the ſmaller baſon an almoſt fixed red earth, or *caput mortuum*. Upon the admiſſion of the cold air the ſnow began ſoon to melt as *per deliquium*, which he *compared to the formation of dew and rain*; and as it dripped from the inſide of the bell upon the concave plate A B, it ran thro' the hole in the middle of it C, by the tube C D, into the receiver E E F; where it was collected in form of a clear tranſparent liquor, ſomewhat clammy like gum-water, which *he called water*. Some of the flowers mixed with any combuſtible matter, as common oil-olive, &c. and put into a golden baſon ſet over a lamp, fired immediately, and flamed like *phoſphorus*, being in reality *phoſphorus* regenerated, and burnt away to a ſubſtance like tar. Some of the clammy water was put into a golden baſon ſet on a lamp, and by augmenting the fire gradually, in about $\frac{1}{4}$ of an hour's time, when

when all the airy bubbles were exhal'd, the liquor became hard like gum, which had been diſſolv'd in water, and was nearly dry, and perfectly tranſparent: This he *calls vitrum molle.* Next day he made ſome more of this *vitrum molle,* which he put into a crucible heated red hot; and then ſet it in a wind-furnace, and gave it the greateſt heat for $\frac{1}{4}$ of an hour, when the matter in the crucible appear'd fluid, like melted glaſs; he then pour'd it out into an iron pan; the matter continued red hot ſome time; when it was perfectly cold, it was hard, tranſparent, and brittle like common glaſs; but it ſoon began to relent, and in 24 hours was almoſt all turned to water again. The Dr. ſaid, if this *vitrum molle* be again entirely reſolv'd in the air, which will take up near 14 days time, by diſtilling off the water, and letting the remainder melt *per deliquium* again, till all the ſaltiſh matter be reſolv'd into water, there remains an inſipid whitiſh earth, which, fluxed in a glaſs furnace, yields a true fixed glaſs.

Some Experiments on the Phoſphorus urinæ, *which may ſerve to explain thoſe ſhewn by Dr.* Frobenius, *together with ſeveral Obſervations to explain the Nature of that ſurpriſing chemical production; by Mr.* Ambroſe Godfrey Hanckewitz. Phil. Tranſ. N° 428. p. 58.

MR. *Hanckewitz* repeated the experiment of the deflagration of *phoſphorus* under a bell (which was firſt ſhewn the *Royal Society* by Dr. *Frobenius*) but he found that a much more ſimple *apparatus* was ſufficient than the pompous machine the Dr. made uſe of: He took a ſtrong wide-mouth'd glaſs jar, which ſerves as a ſtand for the concave glaſs diſh to reſt on. In the middle of the glaſs diſh is a hole communicating with a pipe, which goes down into the above-mentioned jar. Inſtead of the golden baſons, a *china* cup a little warmed, ſerves quite as well for burning off the *phoſphorus*; the laſt and main thing is a large glaſs bell, which fits nearly cloſe upon the glaſs diſh: This bell may be eaſily lifted off and on with the hands by an aſſiſtant, without any frame or ropes to ſuſpend it.

Mr. *Hanckewitz* took one ounce of *phoſphorus,* which he deflagrated in the ſame manner as deſcribed in Dr. *Frobenius's* experiment, and obtain'd of the white ſublimed flowers ten drachms, that is 2 drachms more than the weight of the *phoſphorus* before deflagration; they were ſo very light as to their volume, that they juſt filled an half-pint pot. The ten drachms of flowers being ſet in a cool moiſt place, expos'd to the air, did reſolve into a *liquamen*, weighing 4 ounces and 2 drachms, which *liquamen* much reſembles *ol. ſulphur. per campanam*; but contains an acid ſalt, more fixed in the fire than any other ſalt we know of in nature, and having many other properties peculiar to itſelf, which other acid ſalts have not. The *phoſphorus* receives this fixed acid from the urine only: For, the ſalt of urine is ſo fixed, that upon a live charcoal with a blow-pipe it plays and rolls about like ſilver upon the cupel: Whereas all other liquid acids evaporate with eaſe; this on the contrary is ſo fixed as to require a greater heat for its evaporation than that which keeps lead in fuſion; and the phlogiſtic part, notwithſtanding its lightneſs, is ſo firmly and intimately connected with the reſt of its principles, as to ſuſtain a degree of heat equal to that of red hot iron, during which heat the ſalt ſparkles and emits very bright flames for a good while, which is a very ſurpriſing and agreeable ſight; and this ſparkling being over, it remains red hot in fuſion, and perfectly tranſparent; and by greater heat may be vitrified, as ſhall be ſhewn hereafter. He put the abovementioned *liquamen* into a glaſs-retort, which he ſet in a *balneum mariæ*, and diſtilled it to a ſtrong inſpiſſation; it yielded only an inſipid phlegm, except that towards the laſt it came over a little impregnated with the acid, but not ſharper upon the tongue than if it had been a mixture of ½ an ounce of vinegar with 4 ounces of water. Then removing the retort with the inſpiſſated liquor into a ſand-furnace, he increaſed the heat gradually; ſo as to make the ſand and retort thoroughly red hot, till at laſt the bottom of the retort was ready to melt; he then left it till next day, when being perfectly cold, he broke the retort, and found a moſt admirable white ſalt at the bottom, which was ſo united with the glaſs, as not to be ſeparated from it; and ſome was ſpread all over the retort quite up to the neck, and as near as he could gueſs by inſpection, it ſeemed to be as much in quantity, as the original *phoſphorus* from which it was produced; its taſte was very ſharp and ſaline: But notwithſtanding its great fixity in having endur'd a melting heat for ſeveral hours; it relented again in a moiſt air; and in a few days was entirely reſolv'd into a *liquamen*. The *phoſphorus*, after its deflagration, leaves an almoſt fixed red earth, or *caput mortuum*, behind it, as is mention'd in Dr. *Frobenius*'s experiment. Tho' one would have imagined that all the inflammable parts of the *phoſphorus* had been burnt off in the firſt deflagration, which ſeemed very violent; yet this red earth retains ſo much of an unctuous phlogiſtic, that being put over a red hot fire, it ſwells up, and keeps in fuſion a great while, emitting flames and flaſhes of light, ſo long as it is kept upon the fire: But when cold again, if expos'd to a moiſt air, it relents and reſolves as the flowers do; For, the acid ſalt of the urine adheres ſo ſtrongly to it, that tho' it undergo ſeveral ſtrong ignitious, it will relent again as often, when ſet in the air. He took ſome of the white ſalt that ſtuck to the retort; and in order to try the utmoſt degree of its fixity, he put ſome of it into a crucible, and gave it a vitrifying heat, in which it remained ſome hours, but was not yet run to glaſs, appearing only like a fixed white earth as hard as ſtone, and ſhining as if it were juſt ready to vitrify: Yet it was ſo far fixed, as not to relent any more in the air; had no ſaline taſte, nor was it diſſolvible in water. He, therefore, took another portion of the ſame ſalt of *phoſphorus*, which he kept a longer time in the vitrifying heat, and he found it at laſt run into perfect glaſs: And thus we ſee what a ſurpriſing ſubject *phoſphorus* is! That ſuch an inflammable body, conſiſting of the unctuous and acid parts of the urine, ſhould thus become glaſs.

From this remarkable experiment he concludes, that here is a perfect tranſmutation of bodies; the *phoſphorus* being tranſmuted into a fine tranſparent glaſs of a bluiſh green colour, coming nearer to the hardneſs of a diamond than any other glaſs, and in the ſame quantity as the *phoſphorus* at firſt made uſe of, which, without any addition, produces this glaſs, ounce for ounce: And here theſe wonderful experiments are brought to their *ne plus ultra.* He farther adds, that the crude *phoſphorus* without any deflagration, but only cut very ſmall, or ſcraped fine with a knife, and laid upon a glaſs diſh in moiſt air, will in about a week's time reſolve into a *liquamen* near 8 times its original weight; which *liquamen* is the ſame in all reſpects, as that produced from the ſublimed flowers by deflagration, and may alſo be vitrified: In ſcraping the *phoſphorus* take great care not to do it too haſtily, leſt by heating it, you ſet it on fire.

Mr. *Hanckewitz* makes the following reflections on the foregoing experiments; as the chemical *phoſphorus* is the principal ſubject of them, he gives ſome account what *phoſphorus* is, and what it chiefly conſiſts of. He thinks that *phoſphorus* does not naturally exiſt in animals by itſelf; but when formed out of urine, by means of putrifaction and fire, its principal contexture

is

is found to confift of a fubtile acid, concentrated by the falt of urine, and of a fat depurated oil. The phlogiftic part is fo flightly connected with the other principles, that the leaft motion, friction, or warmth, fets it on fire. The fixed part feems to confift chiefly in the acid falt of the urine, which is at firft fo intimately concentrated with the phlogiftic part, as in deflagration to be hurried up or fublimed along with it; yet being by this operation freed from it, it becomes fixed, and can by no degree of heat be again fublimed. *Phofphorus* may be call'd an urinous *fapo*, or foap; as it confifts of the faline and oleaginous parts of the urine: But *phofphorus* is not to be got in fo great plenty out of urine alone, as when the *fæces alvinæ* are elixirated along with it, and then brought to a *magma* fit for diftillation; nor is there fo great a quantity of *phofphorus* in the urine of other animals, as in that of men; nor is it to be got from any natural productions, or any parts of animals or vegetables in their crude ftate, before they have undergone concoction in the ftomach of an animal. How far, therefore, the *liquor gaftricus*, the bile and pancreatic juice may contribute to the formation of it, is a difquifition he leaves to the enquiry of phyficians. As to the parts of which *phofphorus* confifts, it may be confider'd as the foot of a deflagrated oil; and fo may every combuftible fubftance be look'd upon as a kind of *phofphorus*, as confifting of inflammable materials. *Phofphorus* is more immediately compounded of a falt tending to the nature of *fal ammoniac*, of an urinous falt, of an acid, and an oily *phlogifton* with a fubtile earth; by means of thefe falts exifting in the urine, the *fæces alvinæ* are the better elixirated, and thofe particles extracted which contribute to the formation of the *phofphorus*: With thefe falts are very intimately combined in the *phofphorus* oleaginous or fat particles, which are the proper materials of that fubtile *phlogifton*, the true *domuncula ignis*; and indeed the main conftituents of the whole compound.

As to the preparation of this furprifing production, it is done by diftilling the faponaceous *magma* in a clofe veffel, with a reverberatory fire, much ftronger than that made ufe of for diftilling *aqua fortis*, or the other mineral acid fpirits; the reft of the proper *encheirefis* belongs only to the operator to manage *fecundum artem*. When this operation fucceeds rightly there comes over, 1. A thick unctuous oil. 2. A more fubtile oil, refembling the *oleum philofophorum*, which is oil olive diftill'd from brick duft. 3. The fixed acid enclofed in a very fubtile acid: Near the end of the diftillation comes over that depurated

rated oil, which constitutes the inflammable part of the *phosphorus*, which is not rais'd up till the last, and that by the continuance of a very strong reverberatory fire. But an operator not well exercised in the degrees of fire, and who knows not how and when to take away these oils apart, shall have nothing but a volatile salt, and fetid oil, and get at last only a little unctuous opaque *phosphorus*, such as the famous *Kunckel*, Dr. *Crafft* and *Brand* did, as they acknowledge in their writings, but not the hard transparent glacial *phosphorus*. Since *Kunckel*, therefore, and his followers, were never able to make the true solid glacial *phosphorus*, it was absurd for him to write, that he could make it even out of crude indigested things in their natural state: For, either this famous man spoke too much at large, and had never tried the experiments; or else he must design to impose upon the world: For, Mr. *Hanckewitz* can boldly contradict him as to this point from the several experiments he himself made; but he never found any true *phosphorus* except in such things as had undergone digestion in animals. And he knows himself to have been for these 40 or 50 years, that is, ever since he left Mr. *Boyle*'s laboratory, the only person in *Europe* able to make and produce in any quantity the true solid *phosphorus*. Mr. *Hanckewitz* did not content himself to work upon the urinous *sapo* of man only, but he likewise examin'd the excrements of other animals; as of horses, cows, sheep, &c. and got *phosphorus*, but not in so great quantities as from man; probably, because they feed on nothing but vegetables: He then made experiments on the excrements of lions, tygers and bears, as also on those of cats and dogs, which being carnivorous animals, he obtain'd more *phosphorus* thence than from other animals; he likewise had *phosphorus* from the excrements of rats and mice; and a little from hens and pigeons. He emptied the guts of fish in order to get their excrements, and he had a little *phosphorus* from these; but none from the fishes by themselves. He was next induced by *Kunckel*'s assertion to try what he could obtain from crude vegetables, as corn and other fruit: He thought that putrifaction would bring them the nighest to an ammoniac and urinous state; because of the heat that is produced in them by it; but his labour was all in vain. After these experiments he took in hand fossils and minerals: He began with the common fossil coal, thinking that the *phlogiston* in this bituminous substance, might have been to his purpose; but he could find nothing therein like *phosphorus*, there coming over only a bituminous oil; and at last by increasing the fire to the

the higheſt degree, there ſublimed ſome white talcky flowers, which were neither ſulphureous, nor acid, nor alcaline, but inſipid like talck: And ſo he gave up all farther experiments on other minerals. He often wiſhed for a ſufficient quantity of the flies that ſhine in the dark, of which there are great numbers in *Italy*, eſpecially in *Tuſcany*; or of our common glow-worms, which ſeem to have *phoſphorus* lodged in their bodies.

Phoſphorus is a ſubject that occupies much the thoughts and fancies of ſome alchemiſts, who work on microcoſmical ſubſtances, and out of it they promiſe themſelves golden mountains: The famous Dr. *Dickinſon*, phyſician to king *Charles* II. toil'd and labour'd ſeveral years in experiments on the *ſtercus humanum*, and he ſeveral times ſhew'd Mr. *Hanckewitz* metallic *regulus*'s he had extracted from it: And this is what M. *Hanckewitz* has often done himſelf; and no wonder! For we take in daily with our food, and ſometimes in medicines, both mineral and metallic ſubſtances, beſides what metallic veſſels, as kettles, pots and diſhes furniſh: We ſee a ſolution of the metal upon a knife after cutting any acid fruit, by the black ſpots it hath upon it, and the metallic taſte it communicates to the thing it cuts. Dr. *Liſter* hath ſhewn, that ſtones from the human bladder being calcined, may have iron extracted from them by a loadſtone: And *Boerhaave* hath made it evident, by various experiments, that there is ſcarce any terreſtrial ſubſtance, either in men, brutes, or plants, which after calcination doth not exhibit ſome metallic particles. Dr. *Becher* affirms, that from brick-earth mix'd with any fat or oil, and calcined in the fire, he hath produced iron: For, it is only the iron that cauſes the redneſs of the bricks, and it may be extracted from them again. Moreover, metals are diſſolv'd by the ſalts and moiſture of the earth; and ſo mix with the nutritious juices of vegetables: Hence it may, in ſome reſpect, be ſaid that we eat metals with the greateſt part of our food.

There is got from the *reſiduum* after the *phoſphorus* is made, a particular ſalt which Mr. *Hanckewitz* calls *Sal phoſphori*. This ſalt is fixed in ſome degrees of fire, yet it may be ſublimed in a cloſe veſſel, which other fixed ſalts cannot, except they ſtill contain ſomewhat volatile in them; but this ſalt hath no ſuch thing in it, neither is it any ways alcaline. How to produce this ſalt, remains as much a ſecret as the *phoſphorus* itſelf: For, he that cannot produce this ſalt, will never be able to make *phoſphorus*.

There

There is ſcarce any body, out of which a chemical operator cannot produce water and earth, ſalts, or an acid ſpirit, and an urinous unctuoſity, in greater or leſs quantity, according to the nature of the body; and where there is one of theſe, there is fire to be demonſtrated, but not without each other's help. From the preparation of *phoſphorus* we may reflect upon the *fuligo*, or ſoot of all combuſtible ſubſtances: For, it is the *phlogiſton* only that burns and produces flame; it is lodged in ſulphureous bodies, and unctuous earths, in pitch, roſin, wax and oils, and in the fat of animals; but the fineſt exiſts in ardent ſpirits, which when brought to that ſurpriſing ſubtilty, as that liquor deſcribed by Dr. *Frobenius* in *Phil. Tranſ.* N° 413, do truly deſerve the name of *æther*.

From what has been ſaid, we ſee, 1. That the ſaponaceous *magma* of urine has great affinity with common ſulphur; being a ſulphureous body compos'd of an acid and depurated oil, join'd with a ſmall proportion of earth. 2. Mr. *Hanckewitz*'s phoſphoreal *magma* comes very near the *pyrophorus* of *Homberg*, which wants only the ſalt of urine in it; in the room of which allum is us'd to fix the ſulphur. 3. Hence we may obſerve, that urinous particles exiſt in greater abundance in animals, but the *phlogiſton* abounds moſt in vegetables, from which is prepar'd that fine æthereal ſpirit ſhewn by Dr. *Frobenius*. 4. We produce the *phlogiſton* out of fat ſubſtances, and from the *phlogiſton* a *fuligo* or ſoot, and from the *fuligo* an urinous ſalt. 5. From the corroſive oil of ſulphur we have a pure ſubtile oil, which is intimately combined with it, and is the actual fire of the *phoſphorus*; which, by barely rubbing, or the leaſt degree of heat, is kindled into flame. 6. He who knows perfectly the method of making *phoſphorus* can chooſe whether he will ſublime his *magma* of urine into *phoſphorus*, or into ſulphur; for, the difference conſiſts only in the *encheireſis*.

Obſervations of the appearances among the fixed Stars, *called nebulous* Stars; *by Dr.* Derham. Phil. Tranſ. N° 428. p. 70.

DR. *Derham* having in autumn 1732 made ſome good obſervations with his 8 foot reflecting teleſcope of the appearances in the heavens, call'd *nebulous ſtars*, communicated them to the *Royal Society*, to incite others to make farther obſervations of them; becauſe he thinks there is much more in them worthy the enquiry of the curious than hath hitherto been imagined; and becauſe he was apprehenſive he could not purſue his

his obſervations much farther, by reaſon of his reflecter loſing its excellence and power, by beginning to tarniſh: For, in order to have a good view of theſe *nebuloſe* appearances one muſt neceſſarily make uſe of very good glaſſes, elſe all his labour will be loſt, as the Dr. found by experience. Theſe appearances in the heavens have bore the name of *nebuloſe ſtars*: But they are neither ſtars, nor ſuch bodies as emit, or reflect light, as the ſun, moon and ſtars do; nor are they congeries or cluſters of ſtars, as the *milky way*; but whitiſh *areæ*, like a collection of miſty vapours; whence they have their name. There are ſeveral of them diſpers'd about in divers parts of the heavens. The following catalogue of them, tranſcribed from *Hevelius*'s *prodromus aſtronomiæ*, may be of good uſe to ſuch as have a mind to enquire into them.

A catalogue of the *Nebuloſæ*.

Their places.	Their R. Aſc. Anno 1660 gr.	′	″	Their Declinat. Anno 1660 gr.	′	″
In *Andromeda*'s girdle	6	4	45	39	27	57N.
In *Capricorn*'s forehead	300	2	53	20	1	53S.
Another preceeding *Capric.* eye	301	59	55	19	11	30S.
Another following it	302	35	9	19	36	0S.
One above theſe adjoining to the eye of *Capricorn*	302	25	31	18	48	58S.
Preceeding above the *Swan*'s tail, and laſt in its N. foot	304	54	8	47	54	20N.
One following a ſtar above the *Swan*'s tail, out of the conſtellation	312	10	5	53	7	20N.
On the outſide of *Hercules*'s left foot	264	52	46	48	9	10N.
In *Hercules*'s left leg	265	38	37	38	5	50N.
On the top of *Hercules*'s head	252	24	3	13	18	37N.
At *Pegaſus*'s ear	332	58	45	3	3	12N.
In the weſtern border of *Sobieski*'s ſhield	272	32	34	14	23	35S.
Under the beam of *Libra*'s ſcales	219	26	15	9	16	27S.
Above the back of *Urſa major*	183	32	41	60	20	33N.
In the 3d joint of *Scorpio*'s tail	12	43	0	19	1	0
	Sagitt. Long.			S. Lat.		
Between *Scorpio*'s tail and *Sagittarius*'s bow	24	32	0	11	25	0
	Sagitt. Long.			S. Lat.		

 Beſides

Besides these Dr. *Halley* in *Phil. Transf.* N° 347. hath mentioned one in *Orion*'s sword, another in *Sagittarius*, a third in the *Centaur* (never seen in *England*) a fourth preceeding *Antinous*'s right foot, a fifth in *Hercules*, and that in *Andromeda*'s girdle. Five of these six Dr. *Derham* carefully view'd with his excellent 8 foot reflecting telescope, and he found them all to be phenomena much alike, excepting that which preceeds *Antinous*'s right foot, which is not a *nebulose*, but a cluster of stars, somewhat like that which is in the *milky way*. Between the other 4 he finds no material difference, only some are rounder, some of a more oval form, without any fixed stars in them to cause their light; only that in *Orion* hath some stars in it, visible only with the telescope, but by no means sufficient to cause the light of the *nebulose* there. But it was by these stars that he first perceiv'd the distance of the *nebulose* to be greater than that of the fixed stars, which put him upon enquiring into the rest of them; every one of which he could very visibly and plainly discern to be at immense distances beyond the fixed stars near them, whether visible to the naked eye, or telescopic only; nay they seemed to be as far beyond the fixed stars, as any of those stars are from the earth.

And now from this relation of what he has observed from very good and frequent views of the *nebulose*, he concludes them certainly not to be lucid bodies, that send their light to us, as the sun and moon do; nor the combined light of clusters of stars, like that of the *milky way*: But he takes them to be vast *areæ*, or regions of light, infallibly beyond the fixed stars, and devoid of them: By *regions* he means spaces of a vast extent, large enough to appear of such a size as they do, at so great a distance from us. And since these spaces are devoid of stars, and even that in *Orion* itself hath its stars bearing a very small proportion to its *nebulose*, and they are visibly not the cause of it, he leaves it to others to judge, whether these *nebulosæ* are particular spaces of light; or rather whether they may not, in all probability, be chasms, or openings into an immense region of light beyond the fixed stars; because he finds that most of the learned in all ages (both philosophers, and divines too) have thus far concurred in this opinion, namely, that there was a region beyond the stars. Those that imagin'd there were crystalline or solid orbs, thought that a *cœlum empyræum* was beyond them and the *primum mobile*; and they that maintain'd there were no such orbs, but that the heavenly bodies floated in the *æther*, imagin'd that the starry region was not the bounds of

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the universe, but that there was a region beyond that, which they call'd the third region, and third heaven.

To conclude; it may be of use to take notice, that in *Hevelius's nebulose*, some seem to be more large and remarkable than others; but whether they be really so or no, the Dr. has not had the opportunity of observing, except that in *Andromeda*'s girdle, which is as considerable as any he has seen. In *Hevelius*'s maps of the constellations, the most remarkable are the 3 near the eye of *Capricorn*; that in *Hercules*'s foot; that in the third joint of *Scorpio*'s tail; and that between *Scorpio*'s tail and *Sagittarius*'s bow.

Some magnetical Observations made in May, June, July, 1732, *in the Atlantic or Western* Ocean; *as also the Description of a* Water-spout; *by Mr.* Joseph Harris. Phil. Trans. N° 428. p. 75.

THE knowledge of the magnetical variation is of such consequence to the mariner, that without it he cannot know his course; and were the theory thereof once establish'd, it might be of considerable use for estimating the longitude in several parts of the world, as has been often and very justly observ'd by others: But till this be determined, we must rely upon observations. Some time before, Mr. *Harris* had taken notice of the imperfections of the common azimuth compass, and how ill adapted that instrument was for the purpose intended: He also gave the description of a new instrument, whereby he propos'd to remedy the principal objections to the former; and farther experience has sufficiently confirmed him in what he then advanced. But he would be glad to have it determined by those who have convenient opportunities of making experiments of this kind, what would be the propereit diameter and weight for a needle and card, and what ought to be their proportional weights to each other when taken separately; regard being had that the friction be no more than what is necessary to prevent the card from being too much affected by the motion of the ship. Some observations made him apt to think, that a sea-card should not exceed 6 inches diameter, and that most of those generally used are too heavy for nice experiments, tho' they may be well enough adapted for common purposes.

In *March* and *April*, 1732, the variation at *black-river* in *Jamaica* was very accurately observ'd to be from 6° to 6° 5′ E. Off the *Havanna*, about 4° and ½ E. The rest of the observations are exhibited in the following table.

Lat.	N.	Lon. from Lond. W.		Variat.		Lat.		Lon. from Lond. W.		Variat.	
°	′	°	′	°		°	′	°	′	°	
27	0	80	0	4	E.	35	55	65	30	5	W.
28	45	80	0	3	$\frac{1}{2}$	38	6	60	30	6	$\frac{1}{2}$
31	0	77	45	1	$\frac{3}{4}$	39	10	57	30	8	$\frac{1}{3}$
32	15	72	30	0		39	40	56	30	8	$\frac{1}{4}$
32	40	72	0	1	W.	43	0	45	0	9	$\frac{1}{2}$
32	45	71	30	1	$\frac{1}{2}$	43	5	44	35	9	$\frac{1}{2}$
32	52	70	40	2	$\frac{1}{4}$	44	40	35	15	11	$\frac{1}{2}$
34	30	67	25	4	$\frac{1}{3}$	47	20	20	20	11	

The inſtrument he made uſe of was ſo eaſily managed, that unleſs the ſea were pretty rough, an obſervation might be depended upon to about $\frac{1}{4}$ of a degree, had the card performed to the ſame exactneſs. But by comparing ſeveral obſervations made under the like circumſtances, as to the weather, it ſeems to him as if the virtue of the needle was not always of equal ſtrength. Sometimes ſeveral obſervations would agree exceedingly well; at other times the card would ſtand indifferently any where within a degree or more of its meridian; and thus he obſerved in ſeveral cards: He found another circumſtance which ſurpris'd him much: The card would ſometimes differ about 2 degrees from itſelf between the morning and evening of the ſame day; and this difference would continue regularly, as it were, for ſeveral days, then vaniſh for a week or more; and afterwards would return and continue as before. The greatneſs of this difference, and the near agreement between the obſervations made in the ſame forenoon, or afternoon, amongſt themſelves, would not give him room to ſuſpect that it proceeded altogether from an error in obſerving: He owns he cannot account for it; but whatever be the cauſe thereof, the error was always the ſame way; that is, the weſterly variation in the morning would be leſs than in the afternoon: He carefully examin'd if this could be any ways owing to the inſtrument, or to any iron near the place where it was uſually ſet for obſervation; but he was fully convinced it could proceed from neither. He knows not whether any ſuch obſervations as theſe have been made before; but he thinks it would not be unuſeful, if thoſe who have proper inſtruments, and are ſufficiently ſkill'd, would communicate any thing of this kind that may occur.

It

It now appears that the numbers in the foregoing table cannot be ſtrictly accurate; but he thinks the error can ſcarce any where exceed half a degree; for, in moſt caſes ſeveral obſervations were made pretty near together, of which he took a medium, making allowances according to the circumſtances attending each; and probably, they are as exact as can be well expected from ſea-journals; and there can be no ſenſible error as to longitudes; their reckoning when they made the land, happening to fall out to a more than uſual exactneſs.

About ſun-ſet *May* 21, 1732, in Lat. 32° 30′ N. and Long. 9° E. from the meridian of cape *Florida* they obſerv'd a water-ſpout, as repreſented by Fig. 6. Plate XI. When it was firſt ſeen, it was whole and entire; and much of the ſhape and proportion of a ſpeaking trumpet; the ſmall end being downwards, and reaching to the ſea, and the big end terminating in a black thick cloud: The ſpout itſelf was alſo very black, and the more ſo the higher up: It ſeemed to be exactly perpendicular to the horizon, and its ſides perfectly ſmooth, without the leaſt ruggedneſs; where it fell, the ſpray of the ſea roſe to a conſiderable height, which made ſomewhat of the appearance of a great ſmoke. From the firſt time it was ſeen it continued whole about a minute, and till it was quite diſſipated, about three minutes: It began to waſte from below, and ſo gradually up, whilſt the upper part remain'd entire, without any viſible alteration, till at laſt it ended in the black cloud above: Upon which there ſeemed to fall a very heavy rain in that neighbourhood: As it waſted, the bottom of the remaining part was irregular, ſomewhat like the trunk of a tree broke aſunder: There was but little wind, and the ſky elſewhere was pretty ſerene. The ſpout was judged to be about two leagues off; and Mr. *Harris* thinks the angle under which the ſmall end appear'd, muſt be at leaſt 20′; according to which eſtimation, its thickneſs muſt be upwards of 60 yards, and its height or length about ¾ of a mile.

An Account of an Earthquake, *that in* 1731 *infeſted* Apulia *and almoſt all the Kingdom of* Naples; *by Dr.* Cyrillus. Phil. Tranſ. N° 428. p. 79. *Tranſlated from the* Laitn.

DR. *Cyrillus* made the following ſhort abſtract from the obſervations ſent him by Dr. *Roſetti* from *Apulia*, and from thoſe of others who lived at *Giovenazzo* and *Foggia*.

March

March 9, 1730-1, O. S. at 4 in the forenoon, there was an earthquake almoſt all over the kingdom of *Naples*, but it was felt moſt in *Apulia*: While it laſted, all thoſe appearances taken notice of by the ancients, were here alſo obſerv'd: As firſt a tremor; then a pulſe (σφυγμος) according to *Ariſtotle*, or a ſuccuſſation, as *Poſſidonius* from *Seneca* calls it; and laſt of all an inclination, or a nutation of the earth, like that of a ſhip, as it were: Theſe various motions ſucceeded one another alternately for three minutes and a few ſeconds. It was not obſerv'd by Dr. *Roſetti* whether the nutations and oſcillations were made in parallel circles of the earth, as modern philoſophers have conſtantly obſerv'd of this phenomenon; which is a conſiderable argument for eſtabliſhing the diurnal motion of the earth: This indeed the Dr. himſelf and others carefully obſerv'd both in this and other nutations of the earth. At that time the air was overcharged with denſe, low, and immoveable clouds, which were afterwards diſſipated by a gentle northerly wind: Next day the ſun ſhone more languid, as if he had been cover'd with very thin clouds, tho' there were then none in the heavens. This phenomenon was likewiſe obſerv'd in the following ſtronger ſhocks. The fiſhermen near the ſhore obſerv'd the ſea ſwell ſuddenly, and they weather'd out a ſtorm from *Siponte* and *Barletta*, that is, nearly, from the north, without any wind, but not without apprehenſions of being ſhipwreck'd.

March 10, at 8 o'clock in the forenoon, there happened a new, but a ſhorter, and withal a weaker earthquake in the ſame province; but not ſo weak but that it was felt at *Naples*. This was preceeded by a kind of accenſion, or ſhort coruſcation about mount *Garganus*, obſerv'd by the inhabitants of *Terra di Bari*, and which inſenſibly vaniſh'd into ſmoke or darkneſs. In the parts about *Foggia* a ſtrong N. E. wind generally preceeded this ſecond earthquake, as alſo the others that happened afterwards in *April*, *October*, and *November*; tho' ſometimes the air were altogether calm. The number of houſes that fell, and of men buried in their ruins was conſiderable; no leſs than 600: The town of *Foggia* ſeem'd to be the centre of theſe ſhocks: For, there the ſhocks and downfall of the houſes were more conſiderable; and from thence they diffus'd themſelves to more remote places, the *impetus* gradually remitting; ſo that it may be ſaid that the propagation of this earthquake was ſucceſſively ceffively diminifh'd (unlefs the different folidity and interruption of the interjacent earth caufed any alteration) in the duplicate ratio of the diftances, according to the common laws of nature in other kinds of motion; which was carefully obferved in the ofcillations of pendulum's placed at different diftances from *Foggia*: For pendulum's of a palm in length at *Afcoli di Satriano*, and at *Giovenazzo*, and applied to a graduated femi-circle, and moving in the concuffions of the earth, erred more or fewer degrees from the centre of ofcillation, according as they were more or lefs diftant from *Foggia*: For, the number of thefe degrees (greater in the nigher *Afcoli*, and lefs in the remoter *Giovenazzo*) anfwer'd nearly to the duplicate ratio of the diftance of thefe places from the centre of the earthquake: And hence it likewife happened, that when there was but a very flight trembling at *Foggia*, the pendulum moved flowly at *Afcoli*, but ftood ftill at *Giovenazzo*.

In almoft all the fhocks for the year, it was conftantly obferv'd, that a crafhing in the air and a horrid noife preceeded them; *Pliny*, *lib.* 2. *p.* 80. alfo obferves, that fometimes terrible founds, bellowings, and fhouts like human ufhered in earthquakes. This crafhing in the air was diffus'd in a contrary direction: For, whereas the parts of the earth were fhook by a motion from the centre to the circumference; fo on the contrary, the motion of the air plainly converged from the circumference to the centre; which phenomenon may have yielded no fmall matter of fpeculation to naturalifts: The Dr. would obferve that this is different from what *Ariftotle* thought was the cafe with meteors, namely that an external wind muft contribute to an earthquake, as according to him the coaft of *Achaia* was fhook by the conflict of a north and fouth wind; unlefs, perhaps, you would fay, as fome have fufpected, that at leaft the flight and ofcillating earthquakes produced after ftrong eafterly winds, might have been owing to the retarded diurnal motion of the earth; at leaft in that tract where the wind blew.

Laftly, it is worth obferving in this earthquake, that near a country farm of *Carthufians*, call'd *Tré fanti* (whofe houfe had by the earthquake been levell'd with the ground fince the firft of *March*) in that fpot where the channel of the *Fontana del pefce* is moft deprefs'd, there broke out in a plentiful ftream a new fpring of muddy and hot water. This indeed,

indeed, is no new thing, nor was it unknown to the ancients: Since we find from their accounts, that waters burst out when the body of the earth opens, in the same manner as water enters thro' the seams of a ship; nay, they give an account not only of small streams, but deluges of water that drowned whole cities; which may seem more probable to those who hold with *Thales*, according to *Seneca*, that the earth, supported by the waters, sometimes floats like a ship: But these things will seem absurb to such as know the true structure of the terraqueous globe. The water that burst out in *Apulia* began to dry up gradually, and in a month's time it quite disappeared; but the dry sand, even for some time, retained a sulphurous smell. Thus *Pliny lib.* 31. 4. affirms, that earthquakes pour out and drink up waters: Wherefore, it is not surprising, that we have accounts of lakes, fountains, or rivers breaking out, where there were none before, and of others being dried up. It was universally reported, that shallow wells did at the time of the first earthquake throw out their waters from their wide mouths: Yet it is not at all credible that from the greatest shock water should burst out, (for, this could not have happened without at least overturning and entirely destroying the kingdom of *Naples*) but that probably, new water springing up in the bottom of these wells, as in other places, and filling their cavities, it was thrown out.

In fine, the water which, as has been said above, had burst out near *Tré Santi*, when examined, exhibited the following phenomena.

1. Bulk for bulk by the areometer it weighed 82 grains more than rain water; and only 15 grains more than the water of a brackish fountain in that place. 2. A pound of the same water distill'd to dryness left behind in the bottom of the vessel half a drachm of a substance inclining to the nature of *crocus martis*, sprinkled over with a scruple of a white and insipid earth: The loadstone attracted some reddish particles from this dust after drying it. In the distillation a sulphurous smell was pretty sensible. And hence, after the experiments of the celebrated M. *Lemery*, we have a new accession of arguments, that subterraneous fires and vulcano's may be easily accended by the commixture of sulphur and iron; and consequently, that earthquakes may be produced by the successive kindling of latent fires. 3. In fine, 10 drachms of the galls, called *di levante*, and with which ink is made, reduced to a very fine powder, and infus'd for

four

four hours in two pounds of that water, began to tinge it of a light azure colour, with a subsequent precipitation of the powder.

A Lunar Eclipse observ'd at Rome, December 1. 1732. *by S. S.* Revellus, Borario, *and* Manfredi. Phil. Transf. N° 428. p. 85. *Translated from the* Latin.

THE observations were made with a telescope of 10 palms in length.

True time p. m. H.	′	″	
8	45	28	The *penumbra* now sensible.
	49	14	The *penumbra* denser.
	51	19	The beginning of the eclipse.
		44	*Grimaldus* begins to immerge.
	52	47	Entirely hid.
		54	*Galilæus.*
	53	48	The shadow at *Gassendus.*
	56	2	*Gassendus* entirely hid.
	57	23	*Schickardus.*
9	2	43	*Keplerus.*
	4	53	*Aristarchus.*
	5	0	*Lansbergius* and *Mare humorum* almost entirely hid.
	6	13	*Bullialdus.*
		53	*Capuanus.*
	7	8	The shadow at *Mare Nubium.*
	8	2	*Copernicus* begins to immerge.
		29	The shadow at the middle of *Copernicus.*
	10	27	The shadow at *Eratosthenes*, and *Copernicus* entirely hid.
	14	12	*Tycho* begins to immerge.
		45	*Insula sinus medii.*
	15	37	*Heraclides.*
	16	22	*Tycho* is now hid.
	18	12	*Tymocharis.*
	20	4	*Archimedes.*
	21	4	*Harpalus.*
	23	10	*Manilius.*
		16	*Helicon.*
		40	*Plato.*

True time p. m. H.	′	″	
9	26	21	*Menelaus* is now hid.
	28	55	*Catharina* and *Cyrillus*
	30	11	*Plinius.*
		56	*Dionyſius.*
	32	31	*Ariſtoteles.*
	33	11	*Promontorium Acut.*
	34	27	*Fernelius.*
	35	51	*Snellius.*
	36	11	*Poſſidonius.*
		41	*Petavius.*
	37	45	*Promontorium ſomnii.*
	38	25	*Langrenus.*
	40	24	*Hermes.*
	41	0	*Proclus.*
		30	*Mare Criſium* begins to immerge.
	42	32	*Cleomedes.*
	45	10	The ſhadow at the middle of *Mare Criſium.*
	46	20	*Meſſala.*
	48	24	The total immerſion.
	57	5	The duration of the total immerſion.
11	31	13	The emerſion had now undoubtedly began.
	33	13	*Grimaldus* emerged.
	46	3	The middle of *Copernicus.*
	51	17	*Tycho* emerged.
		52	*Plato.*
	53	13	*Archimedes.*
	56	36	*Inſula ſinus medii.*
	59	57	*Eudoxus*
12	2	10	*Manilius.*
	3	26	*Ariſtoteles.*
	4	25	*Menelaus.*
	8	11	*Poſſidonius.*
	13	6	*Plinius.*
	17	14	*Promontorium acutum.*
	20	38	*Langrenus.*
	23	21	*Mare Criſium* entirely emerged.
	26	55	The end of the eclipſe.

The duration of the whole eclipſe was $3^h\ 35'\ 36''$

Som

Some phaſes of the immerſion by another obſervation with a reflecting teleſcope.

True time. p. m. H.	′	″	
8	50	13	The *penumbra* denſe.
	51	28	The obſcuration certainly began.
	54	8	*Grimaldus* entirely hid.
		32	The ſhadow at the middle of *Galilæus.*
9	0	58	*Keplerus* entirely hid.
	2	18	The ſhadow at *Ariſtarchus.*
	3	37	*Ariſtarchus* entirely hid.
	8	3	The ſhadow at the beginning of *Copernicus.*
	9	20	At the middle of *Copernicus.*
	10	32	*Copernicus* entirely covered.
	14	47	The ſhadow at the beginning of *Tycho.*
	23	11	At the beginning of *Manilius.*
		26	At the beginning of *Plato.*
		55	The ſhadow thro' the middle of *Plato* and *Manilius.*
	24	40	*Plato* entirely covered.
	39	35	The ſhadow at the beginning of *Proclus.*
	40	18	The ſhadow at *Hermes.*
	41	0	*Proclus* entirely covered.
		31	The ſhadow at the beginning of *Mare Criſium.*
	44	20	At the middle of *Mare Criſium.*
	46	15	*Mare Criſium* entirely immerged.
	49	3	The moon entirely immerged.

An Eclipſe of the Moon *obſerv'd in* Fleet-ſtreet, London, Nov. 20. 1732. *at Night; by Mr.* George Graham. Phil. Tranſ. N° 428. p. 88.

	H.	′	″	
The beginning at	8	1	30	apparent time.
Immerſion.	8	59	30	
Emerſion.	10	38	0	
End	11	37	0	

Obſerv'd with a ſmall teleſcope about 18 inches long, that magnifies about 13 times.

Mr. *Hodgſon* at Chriſt's hoſpital did with a 4 foot teleſcope obſerve the beginning at $8^h\ 1'$ and $\frac{1}{2}$, and the end at $11^h\ 36'$ and $\frac{1}{2}$.

The Bills *of* Mortality *for the Town of* Drefden, *for a Century*, viz. *from* 1617 *to* 1717, *containing the Numbers of Marriages, Births, Burials, and Communicants; by* Sir Conrad Sprengell. Phil. Tranf. N° 428. p. 89.

The Year.	Coup. marr.	Chrif-tened.	Buried.	Commu-nicants.	Who receiv'd Holy Orders.
1617	126	478	639	21507 among whom were	37
1618	175	466	400	22567	31
1619	148	530	332	23221	34
1620	119	546	472	22850	36
1621	146	546	491	23988	18
1622	144	521	381	24032	16
1623	127	541	421	25864	20
1624	146	576	411	25899	15
1625	141	543	481	26319	21
1626	151	580	407 befides 333 who died of the Plague.	29201	27
1627	162	548	412	26677	29
1628	124	543	469	27085	17
1629	136	599	398	28525	18
1630	115	599	480	28446	28
1631	163	599	844	30241	23
1632	161	515	3129 during the Troubles of the War and Plague.	32416	46
1633	412	425	4585 The Troubles of War and the Plague ftill continuing.	27688	57
1634	346	531	721	23165	47
1635	205	523	597	24942	24
1636	153	531	594	23904	26
1637	156	613	1897 The Plague breaking out again.	28888	19
1638	205	550	531	26744	43
1639	122	602	1845	28702	24
1640	192	451	935	26032	30

The Year.	Coup. marr.	Chrif-tened.	Buried.	Commu-nicants.	Who receiv'd Holy Orders.
1641	144	509	525	25662 among whom were	22
1642	155	514	601	27247	20
1643	137	623	1041	28720	30
1644	128	561	489	27677	28
1645	118	497	532	27602	22
1646	134	512	481	27996	9
1647	148	655	471	36619	21

In which year they began to deliver in the number of communicants at *Old Dresden*.

1648	190	714	606	37097	23
1649	179	664	597	39198	21
1650	197	752	494	39588	26
1651	199	713	511	39773	19
1652	206	732	450	40389	24
1653	193	673	535	40924	20
1654	194	691	558	41789	28
1655	180	725	525	40253	26
1656	212	708	560	43086	15
1657	163	610	663	44783	30
1658	186	707	518	43117	16
1659	194	703	599	43297	29
1660	219	738	542	45111	23
1661	196	709	649	45137	28
1662	180	733	637	45313	27
1663	193	640	620	45640	31
1664	176	682	662	46115	42
1665	228	734	699	46667	33
1666	188	699	824	47194	32
1667	247	754	823	47325	20
1668	237	739	703	48403	17
1669	215	833	794	48765	27
1670	251	802	776	50121	22
1671	262	844	743	51500	26
1672	275	856	909	51650	32
1673	252	891	909	52483	26

The

The Year.	Coup marr.	Christned.	Buried.	Communicants.	Who receiv'd Holy Orders.
1674	256	887	846	52636	among whom were 199
1675	257	920	947	53179	255
1676	260	895	1284	51164	288
1677	322	988	887	53079	311
1678	204	1028	1020	53510	222
1679	308	1063	975	55296	300
1680	247	883	1311 besides 5103 who died of the Plague	56116	188
1681	531	791	753	45244	188
1682	386	1137, among whom two Blackmoors Children.	1023	51512	211
1683	256	1201	1200	52493	299
1684	270	1039	1154	48855	211
1685	273	984	937	50931	322
1686	244	1020	1199	53754	311
1687	285	1078, among whom a *Turkish* woman.	927	49040	355
1688	274	1062, among whom 1 *Turkish* woman, 3 *Turkish* girls, and 1 *Turkish* man.	1011	54868	233
1689	244	1022	1163	55284	211
1690	370	1002, among whom 1 *Turk*.	1200	57130	266
1691	306	1119, among whom 4 *Turkish* women, 2 *Turkish* boys, and 1 black woman.	1166	56629	333
1692	323	1003, among whom one *Jew*.	999	58995	188

The

The Year.	Coup marr.	Christened.	Buried.	Communicants.	Who receiv'd Holy Orders.
1693	309	1096, among whom 1 *Turkish* man:	1071	59921	among whom were. 29
1694	366	1014, among whom 2 *Turkish* boys.	1426	61288	28
1695	329	1225	1227	62230	35
1696	293	1162, among whom one black man.	1055	64491	23
1697	480	1206	1070	61171	30
1698	332	1007	919	59030	25
1699	295	963, among them one black woman & a *Lapland* man 80 years old.	1139	59662	38
1700	292	975, among them 1 *Turkish* woman, 2 *Turkish* men, and 1 *Jew*.	1198	59369	28
1701	324	991	992	61176	27
1702	210	1086, among them a *Jewess*.	946	60225	27
1703	288	1049, among them a *Turkish* woman.	1078	62636	31
1704	279	1111, among them a black woman.	964	62971	39
1705	354	1044, among them a *Jew*.	1346	64262	30
1706	313	1104	1098	63894	19
1707	296	1034	1523	63120	24
1708	350	1256	1119	66519	30
1709	348	1141, among them a *Jew* and his wife.	1340	67021	41
1710	337	1141, among them 2 *Jews* who apostatiz'd afterwards	1214	69197	24
1711	313	1181	1222	70123	29

The

The Year.	Coup. marr.	Christened.	Buried.	Communicants.	Who receiv'd Holy Orders.
1712	354	1227	1140	72432	among whom were 22
1713	353	1112, among them one *Turkish* man and one *Jew*.	1383	71600	23
1714	306	1312; among them a *Jew*.	1250	75547	33
1715	349	1249, among them a *Jew*.	1353	76155	23
1716	361	1339, among them one black man, one *Jew*, and one *Jewish* girl.	1274	77146	27
1717	397	1445, among them a *Jew*.	1908	78019	19

Sum total from 1617 to 1717 inclusive.

Married 24294 couples. Christened 83412. Buried 98611. Communicants 4654064, among whom 1686 who receiv'd holy orders.

The

The Bills of Mortality for the Imperial City of Augsburg, *from the Year* 1501 *to* 1720 *inclusive, containing the Number of Births, Marriages, and Burials; by Sir* Conrad Sprengell. Phil. Trans. N° 428. p. 94.

N. B. The years mark'd + denote the time of plague, or contagious distempers.

	The Year.	Born.	Coup. marr.	Died.		The Year.	Born.	Coup. marr.	Died.
	1501	1764	043	1984		1531	1853	445	1763
	1502	1984	440	1543		1532	1640	562	1543
	1503	1764	542	1646		1533	1765	573	1172
+	1504	3048	985	4765		1534	1985	583	1282
+	1505	2464	648	3564	+	1535	1410	593	13000
	1506	1974	764	1950	+	1536	1515	770	1492
	1507	1876	665	1754		1537	1519	784	1462
	1508	1764	444	1844		1538	1518	636	1565
	1509	1878	347	1764		1539	1922	639	1575
	1510	1976	765	1979		1540	1842	645	1585
+	1511	2897	896	4870		1541	1283	496	1208
+	1512	1768	786	2980		1542	1439	507	1472
	1513	1875	760	1960		1543	1282	660	1283
	1514	1985	645	1740		1544	1473	887	1179
	1515	1895	692	1622		1545	1483	440	1065
	1516	1470	410	1732		1546	1603	370	1356
	1517	1890	419	1893	+	1547	1646	630	3480
	1518	1980	418	1872		1548	1705	492	1227
	1519	1760	419	1893		1549	2038	819	1757
	1520	1542	320	1760		1550	1205	411	1490
+	1521	2970	322	3895		1551	1867	360	1455
	1522	1765	372	1980		1552	1567	417	1477
	1523	1822	382	1970		1553	1677	498	1665
	1524	1824	392	1989		1554	1270	445	1464
	1525	1827	435	1515		1555	1497	526	1340
	1526	1829	436	1418		1556	1587	447	1239
	1527	1833	438	1522		1557	1520	417	1310
	1528	1763	439	1632		1558	1670	488	1485
	1529	1783	440	1733		1559	1763	467	1555
	1530	1973	442	1893		1560	1297	613	1990

	The Year.	Born.	Coup. marr.	Died.
	1561	1150	468	1310
	1562	1717	454	1744
+	1563	1869	460	2680
+	1564	1872	536	2542
	1565	1779	538	1488
	1566	1861	418	1518
	1567	1723	424	1718
	1568	1757	440	1703
	1569	1838	446	1396
	1570	1884	334	1640
+	1571	1521	318	3071
+	1572	1634	650	3306
	1573	1629	549	1371
	1574	1488	382	1520
	1575	1563	384	1595
	1576	1647	442	1245
	1577	1721	386	1427
	1578	1687	403	1410
	1579	1629	388	1520
	1580	1635	416	1522
	1581	1477	456	1185
	1582	1627	414	1530
	1583	1497	452	1245
	1584	1614	311	1167
+	1585	1568	435	2497
+	1586	1583	526	3136
	1587	1541	578	1545
	1588	1593	420	1468
	1589	1664	426	1372
	1590	1592	405	1678
+	1591	1520	410	1352
+	1592	1632	363	3450
	1593	1581	649	1554
	1594	1629	396	1560
	1595	1517	335	1584
	1596	1639	437	1505
	1597	1608	393	1594
	1598	1552	380	1631
	1599	1486	386	1447
	1600	1621	499	1775
	1601	1575	387	1570
	1602	1468	453	1567
	1603	1570	390	1488
	1604	1551	394	1298
	1605	1272	394	1361
	1606	1587	376	1371
+	1607	1577	361	2595
	1608	1526	578	1476
	1609	1648	477	1469
	1610	1618	435	1941
	1611	1557	466	1891
	1612	1596	410	1625
	1613	1572	437	1722
	1614	1713	404	1444
	1615	1460	368	1771
	1616	1591	446	1631
	1617	1655	429	1514
	1618	1824	414	1354
	1619	1688	419	1485
	1620	1725	463	1667
	1621	1661	443	1517
	1622	1696	435	1959
	1623	1374	451	1875
	1624	1512	383	1370
	1625	1482	386	1392
	1626	1431	299	1440
+	1627	1198	313	2494
+	1628	1106	411	9611
	1629	1121	860	1265
	1630	1052	272	909
	1631	1173	169	859
+	1632	1286	355	3485

The Year.	Born.	Coup. marr.	Died.	The Year.	Born.	Coup. marr.	Died.
1633	1075	537	3364	1669	793	192	743
1634	1054	299	4664	1670	707	228	734
1635	512	416	6243	1671	810	210	733
1636	789	440	790	1672	830	197	768
1637	801	213	823	1673	786	239	751
1638	809	209	638	1674	874	251	842
1639	811	239	674	1675	775	201	913
1640	843	217	586	1676	805	230	913
1641	843	176	587	1677	843	224	934
1642	832	248	593	1678	854	239	943
1643	839	194	638	1679	861	250	945
1644	841	189	659	1680	807	281	976
1645	904	172	758	1681	888	214	860
1646	1221	206	1488	1682	891	214	734
1647	944	256	1338	1783	892	195	808
1648	1482	225	1208	1684	894	234	858
1649	776	233	940	1685	885	230	848
1650	639	191	533	1686	910	247	981
1651	665	190	577	1687	853	281	855
1652	692	178	616	1688	927	231	860
1653	686	150	575	1689	853	213	806
1654	694	197	764	1690	911	262	1071
1655	680	158	570	1691	825	253	785
1656	700	182	641	1692	893	202	935
1657	675	182	731	1693	818	219	1084
1658	659	198	731	1694	760	277	1106
1659	687	187	831	1695	867	262	1048
1660	657	211	657	1696	930	274	927
1661	710	179	668	1697	969	271	777
1662	644	192	788	1698	1020	241	879
1663	675	207	836	1699	1008	268	940
1664	687	224	761	1700	909	217	786
1665	624	272	745	1701	933	230	906
1666	690	209	737	1702	952	249	900
1667	754	193	769	1703	989	190	1245
1668	688	228	711	1704	818	339	1313

The Year.	Born.	Coup. marr.	Died.	The Year.	Born.	Coup. marr.	Died.
1705	890	405	748	1713	837	202	860
1706	949	307	842	1714	874	261	948
1707	1013	240	805	1715	866	309	1024
1708	916	225	908	1716	997	272	905
1709	948	240	805	1717	924	259	988
1710	982	238	811	1718	986	280	768
1711	899	243	855	1719	924	270	997
1712	911	229	894	1720	909	263	934

Mr. *Maitland* makes the following remarks on the aforesaid bills of mortality for the cities of *Dresden* and *Augsburg*.

By the first septenary of the centenary of the bills of mortality for the city of *Dresden* from 1616 to 1624, it appears that there died in that electoral capital 3136 persons; and in the last septenary of the said centenary, from 1709 to 1717, there died 8836.

By the first septenary of the same centenary of the bills of mortality for the imperial city of *Augsburg*, from 1616 to 1624, it appears, that there died in that city 11371; and in the last septenary from 1709 to 1717, only 6297: Whereby is evinced the great vicissitude of sublunary affairs, in the vast disparity between the aforesaid cities: For, as the former has increas'd near two thirds in the number of its inhabitants; so hath the latter decreas'd near one half in the said space of time.

An Account of Symptoms arising from eating the Seeds of Henbane, *with their Cure*, &c. *and some occasional Remarks*; *by Sir* Hans Sloane. Phil. Trans. N° 429. p. 99.

IN 1729 a person came to consult Sir *Hans Sloane* upon an accident that befel four of his children, aged from four years and a half to 13 years and a half, by their eating some seeds they had gather'd in the fields, which they mistook for filberts: By one of the capsules, Sir *Hans* instantly knew it to be that of the *hyoscyamus niger, vel vulgaris* C. B (or the common henbane) which bears some gross resemblance to the husk of a filbert, and the seeds resemble those of the poppy. The symptoms that appear'd in all the four were great thirst, swim-

ſwimmings in the head, dimneſs of ſight, ravings and profound ſleep; which laſt in one of them continued for two days and two nights. Sir *Hans* order'd them all to be bled, bliſter'd in ſeveral places, and afterwards purged with a medicine, compos'd of *elect. lenitiv. ol. amygd. dulc. flor. ſulphur & ſyr. flor. perſicor.* which operated both by vomit and ſtool: And by this method they perfectly recovered.

The *delirium* occaſioned by theſe ſeeds differs from the common, and in ſome meaſure agrees with that produced by the *dutroa*, a ſpecies of *ſtramonium*, and by the *bangue* of *Eaſt India*, a ſort of hemp: And they are all different from that kind of diſorder caus'd by the rubbing with a certain ointment made uſe of by witches (according to *Lacuna*, in his verſion and comments upon *Dioſcorides*) the effect of which (as he was told) is to throw the perſons into a deep ſleep, and make them dream ſo ſtrongly of being carried in the air to diſtant places, and there meeting with others of their diabolical fraternity, that when they awake, they actually believe and have confeſs'd, that they have performed ſuch extravagant actions.

Here Sir *Hans Sloane* gives an inſtance of the great virtues of henbane-ſeeds in the tooth-ach. A perſon of quality tormented with this racking pain, had an empyric recommended to him. The quack convey'd the ſmoke of burning henbane-ſeeds, by means of a funnel, into the hollow tooth and thereby remov'd the pain: But at the ſame time there dropped ſome maggots from the tooth (as he pretended) into a pail of water placed underneath for that purpoſe. Sir *Hans* procur'd one of theſe maggots, which he ſent wrapt up to M. *Leewenhoek* at *Delft* in *Holland*, where it arriv'd ſafe and alive. Upon examination M. *Leewenhoek* found it to be entirely like thoſe bred in ordinary rotten cheeſe: Wherefore he procured ſome of theſe latter, and carefully fed both them, and that one Sir *Hans* had ſent, on the ſame cheeſe; and they were all, according to the uſual methods of nature, turned into ſmall *ſcarabæi*: So that there did not appear the leaſt difference between them either when maggots or *ſcarabæi*, both being return'd Sir *Hans* from *Holland*.

Upon the whole, tho' the ſmoke of the henbane-ſeeds cur'd the tooth-ach; it is highly probable the maggots had been convey'd thither, and let drop into the water by ſome ſlight of hand.

An

An Abstract of a Journal of Meteorological Obſervations, *made at* Petersburgh, *from* Nov. 24. 1724, *to* June 23, 1725, *by Mr.* Conſett; *with Meteorological Obſervations* at Lunden *in* Sweden, *in* 1724; *with Remarks thereon*; *by Dr.* Derham. Phil. Tranſ. N° 429. p. 101.

THIS journal contains obſervations made three times a day of the barometer, the winds and their ſtrength, the weather, and (after *April* 15.) of the thermometer. Mr. *Conſett*, from the beginning, noteth down the barometrical variations, but Dr. *Derham* knows not his diviſions and degrees till *December* 18. at 3h. p. m. and then the barometer was at 30. 66. wind N. E. 1 and fair. From *November* 24, to the cloſe of the month, the weather was cloudy with ſnow, and a deep ſnow on the laſt day, and fair on the 28. the winds were eaſterly, and N. E. of two and three degrees ſtrength, till the 29th and 30th; and then S. E. 3. S. 4. and S. W. 3. In *December* it was cloudy with ſome ſnow, till *December* 8. and 9. which were fair days; then cloudy on the 10. and 11. and rain in the evening; after this ſome cloudy and moiſt weather; ſome fair weather till *December* 23. and then hail; wind S. W. 3. The next day ſnow; and the reſt of the month ſome cloudy and dark weather, with ſnow and ſome fair weather. The barometer ever ſince the 18th hath been above 30 inches, and on *December* 26 it was 30. 84; on *December* 30. 30. 96. and 31. 00. and laſtly on *December* 31. it was 31. 12. On the 3d of *January*, 1724-5, the barometer was at 30. 65. on the 4th before noon at 31. 32; after noon at 31. 36; but on the 5th it was in the afternoon 31. 59; the wind at S. W. 1. and cloudy weather; which is the higheſt range of the quickſilver in all the obſervations; nay, the higheſt he ever met with any where, and at any time: On the other hand, the loweſt range was on *February* 25, at 28. 28. wind W. 4. and ſnow. The barometer was above 30 inches all the beginning of *January*, till the 18th; and then it gradually fell to 28. 36. The winds were for the moſt part in ſome weſterly point till *January* 11. and then S. E. 2. with fair weather, and a hard froſt for a week; the weather before the 11th being cloudy and moiſt, with ſome ſnow now and then; and a little rain, on *January* 1. All the reſt of *January* was for the moſt part cloudy with ſnow; and but little fair, and that attended with froſt. In *February* the barometer continued high, till by a gradual deſcent it came to 28. 98. On *February* 15. and 17.

the wind westerly 3 and 4. But on *February* 25. it fell to 28. 28. wind W. 4. The greatest part of this month the weather was cloudy, and sometimes with thick darkness, frequent snow, and now and then fair, with sharp frost. All *March* the barometer was above 29 inches; sometimes above 30: The greatest part of this month was cloudy, with frequent snow, and some fair weather, with sharp frosts; the winds were variable, and their strength about 1 or 2 degrees all the month, and seldom at 3 degrees, nor calm at any time. All *April* the barometer was above 29 inches, and under 30; in the beginning of the month, snow and cloudy, with some fair, and sharp frosts, till *April* 13. when Mr. *Consett* saith, the continual winter-frosts were thawed; and that on the 15th they left off the fires in the stoves. After this some cloudy weather, some rain and some fair; the winds were variable, commonly 1 and 2 strength; and now and then 3, and not any day 0. From *April* the 16th Mr. *Consett* observed the thermomerer which (being one made by Mr. *Hauksbee*) stood at 51, which is between cold air and temperate; the freezing point being at 65; it then rose for some days to 46 and 40, till on the 22d it was at 36; and towards the end of the Month it fell again to 47. All the Month of *May* the range of the barometer was between 28 and 29 inches; and for the most part above 29. 50. The thermometer was on the 1st day at 52. 8. and continued rising to 50 on the 7th, where it stood to about the 14th, and then rose to 40 for the following days, being at 40. 25. on the 17th in the morning, the wind S. 2. and fair, when in the evening of the same day it rose to 30. 34. the wind W. 2, with rain; it soon got down again to 40 for several days; but from the 27th to the end it was about 30. 50. This month had much more fair weather than any of the preceding months, and some cloudy weather with showers, and some heavier rain. In *June* the range of the barometer was (as in the last month) between 28 and 29 inches, but more frequently under 29. 50. than it was in that month. The thermometer was all this month between 40 and 41, only on the 1st, 2d, 3d, 8th, 11th, 13th and 23d days, it was a little above 31, but never so high as 30, which is between warm air and hot. On *June* 2d, there fell rain with hail: And (as the Dr. has observed in some of the *Transactions*) that cold in summer produces rain; so there fell a great deal of rain on *June* 5. after which, some days were cloudy, with frequent showers, and many days fair, to *June* 23, on which Mr. *Consett*'s observations end.

Dr

Dr. *Derham* wished he could have had some observations in the more southerly parts, to have tallied with these.

The meteorological observations made at *Lunden* in *Sweden* in 1724, that tally with Mr. *Consett's* are as follows. The range of the mercury in the barometer, which seems to be different in both places, as far as can be judged of by the few observations that tally with one another, which is only from *Dec.* 18. to the close of that month, Mr. *Consett's* barometrical divisions before that time not being intelligible; and in all that fortnight's time, the *Petersburgh* barometer was above 30 inches, and once above 31; whereas that at *Lunden* was but a little above 29, and but once at 29.6. And indeed, throughout the whole year, the *Lunden* barometer was only now and then below 29 inches, and much seldomer above 30. He finds in these observations a great conformity between the winds; especially, when strong for some time, and when they have been for some time in or near the same quarter; and this he has observed in other places. As to the weather, no good judgment could be made of it in the space of 5 weeks, which is all the time in which the observations tally: Only the Dr. takes notice that thunder was more frequent at *Lunden* than *Petersburgh* during that time.

The Dr. now proceeds to the whole year's observations at *Lunden*; and he begins with the barometrical ranges, which will be best seen and compar'd by the 2 following tables; the first of which, namely, the mean heights of the mercury, to which the Dr. has added the highest and lowest ranges in each month; as also the author's mean of his thermometrical observations, tho', he owns, he scarce understands the divisions of his thermometer.

The

The highest and lowest ranges of the barometer, and the mean of the barometer and thermometer at *Lunden*, in 1724.

	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*
High	29.8	29.9	30.½	30.½	29.9	29.9
Mean	29.3	29.2	29.4	29.6	29.4½	29.4
Low	28.8	28.6	28.8	29.1½	29.0	28.9
Therm	24.1.	37.1.	21.1.	6.½	13.1.	45.1.
	July	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
High	29.7	29.9	29.9	30.½	30.½	30.1½
Mean	29.2½	29.5½	29.3	29.5	29.5	29.2½
Low	28.8	29.2½	28.7	29.½	28.9	28.3
Therm.	34. 1.	23. 1.	1.½	15.1.	30.1.	43.1.

The heights of the barometer at *Petersburgh*, A. D. 1724 and 1725.

	Dec.	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*
High	31.12	31.59	30.36	30.35	29.87	29.99	29.81
Mean	30.61	29.97	29.32	29.76	29.57	29.67	29.45
Low	30.11	28.36	28.28	29.18	29.28	29.35	29.10
The heights of the thermometer.							
High	—	—	—	—	36. 0	30.34	30.70
Mean	—	—	—	—	45. 0	40.98	40. 0
Low	—	—	—	—	54. 7	52. 8	40.63

By comparing these 2 tables together, it is manifest that the ascents of the mercury are much greater at *Petersburgh* than at *Lunden*; and that the descents are nearly the same: So that the range of the barometer at *Petersburgh* is 3 inches 31 hundredth part; but at *Lunden* only 1 inch and about 8 tenths. And the greatest height of the thermometer at *Petersburgh* was on *May* 17, 30°. 34.

As to the winds and weather at *Lunden* in 1724: In *January* the winds were, for the most part, about the westerly and southerly points, and frequently very boisterous. The weather was some cloudy, some fair with frequent rain, but no cold taken notice of till *Jan.* 30. In *Feb.* the winds frequented the same points as in *Jan.* but they lay more between the N. and E. than then; and they were oftentimes very boisterous. In this month

month ſnow was frequent, and now and then thunder, and bu little fair weather. In *March* the winds were very variable and ſometimes ſtrong; the weather more ſerene than before, with ſometimes ſnow, and towards the latter end rain, and now and then a froſt. In *April* the winds were more northerly and eaſterly than in *March* and not very ſtrong. The greateſt part of the month was freezing, and fair with ſome days of rain with thunder. The beginning of *May* to the 16th the mornings were froſty, with ſome rain, ſome ſnow, and ſome fair the reſt of the day; after the 16th ſome rain and ſome ſnow; and towards the end of the month fairer. The winds were variable, briſk, and about the 23d, 24th and 25th ſtormy. In *June* the winds variable, pretty briſk, and ſtormy on the 10th, 11th and 12th; then the weather was for the moſt part fair till the 15th; after that cloudy, and but little fair, with frequent and plentiful rain. *July* alſo was a cloudy, wet month, with but little fair, and ſome thunder, which was ſometimes violent: The winds, for the moſt part, were between the W. and S. and moderate. In *Aug.* the winds were more northerly and eaſterly than in *July*; and ſometimes between the weſt and ſouth, and moderate in all the points, The firſt 9 or 10 days were, for the moſt part, fair; 9 or 10 days after that, more cloudy, rain, lightning in the evening, loud thunder and rain in the day, and ſome in the night; and from the 20th to the end of the month fairer, with cloudy, hail and rain. In *Sept.* the winds frequented the northerly and weſterly points, were briſk, and ſometimes ſtormy; the mornings, for the moſt part, cloudy the firſt 9 days, and fairer the reſt of the days. The greateſt part of the reſt of the month was rainy, with plenty of ſnow on the 25th; then rain, which continued during the firſt 9 days of *October*; the reſt of that month was cloudy, with hoar-froſts now and then, and ſome fair. The winds varied often, but were the moſt frequent in ſome of the ſoutherly and weſterly points, and not very high. In *Nov.* the winds were ſometimes in the weſterly and ſoutherly points, but more frequent in the northerly and eaſterly, for the moſt part, of a moderate ſtrength. The firſt 9 days the weather was cloudy; then ſnow and froſt to the 17th; then to the end cloudy, ſnow, hoar-froſt, rain, and but little fair, and that in the morning. In *Dec.* the winds were moderate, and often in the ſoutherly and S. W. points, ſeldom northerly. The 5 firſt days were cloudy and wet; then ſnow and froſt the 6th, 7th and 8th; then cloudy to the 13th; then hoar-froſt and fair on the 14th, 15th and

16th;

16th; then cloudy with thunder, rain, ſnow and froſt, at divers times, in the reſt of the month.

An Account of the Damp Air *in a* Coal-pit, *dug within* 20 *Yards of the* Sea; *by Sir* James Lowther. Phil. Tranſ. N° 429. p. 109.

SIR *James Lowther* having occaſion to ſink a pit very near the full ſea mark, for draining one of his principal colliries near *Whitehaven* in *Cumberland*, which would be near 80 fathom in depth to the beſt ſeam of coals, which is 3 yards thick; the work was carried on day and night very ſucceſsfully thro' ſeveral beds of hard ſtone, coal, and other minerals, till the pit was ſunk down 42 fathom from the ſurface, where they came to a bed of black ſtone, about 6 inches thick, very full of joints, or open cliffs, which divided the ſtones into pieces of about 6 inches ſquare, the ſides of which were all ſpangled with ſulphur, and in colour like gold. Under this black ſtone lies a bed of coal 2 foot thick: When the workmen firſt prick'd the black ſtone bed, which was on the riſe ſide of the pit, it afforded very little water, contrary to what was expected; but inſtead of that a vaſt quantity of damp corrupted air, which bubbled thro' a quantity of water, then ſpread over that part of the pit, and made a great hiſſing noiſe; at which the workmen being ſomewhat ſurpris'd, held a candle towards it, and it immediately took fire upon the ſurface of the water, and burn'd very fiercely; the flame being about half a yard in diameter, and near 2 yards high, which frightned the workmen; ſo that they took the rope and went up the pit, having firſt extinguiſh'd the flame, by beating it out with their hats: The ſteward of the works being informed of this went down the pit with one of the workmen, and holding a candle to the ſame place, it immediately took fire again as before, and burnt about the ſame bigneſs; the flame being blue at the bottom, and more white towards the top. They ſuffered it to burn near half an hour, and no water being drawn in that time, it roſe and cover'd the bottom of the pit near a yard deep, but that did very little abate the violence or bulk of the flame, it ſtill continuing to burn upon the ſurface of the water: They then extinguiſh'd the flame as before, and opened the black ſtone bed near 2 foot broad, that a greater quantity of air might iſſue forth, and then fired it again; it burn'd a full yard in diameter, and about 3 yards high, which ſoon heated the pit to ſuch a degree, that the men were in danger of being ſtifled; and ſo were as expeditious as possible in extinguishing the flame, which was then too strong to be beaten out with their hats; but with the assistance of a spout of water, of 4 inches diameter, let down from a cistern above, they happily got it extinguish'd without further harm. After this no candles were suffer'd to come near it, till the pit was sunk down quite thro' the bed of black stone, and the 2 foot coal underneath it; and all that part of the pit, for 4 or 5 foot high, was framed quite round, and very close jointed; so as to repel the damp air, which, nevertheless, it was apprehended would break out in some other adjoining part, unless it were carried quite off as soon as produced out of the cliffs of the stone; for which end a small hollow was left behind the framing, in order to collect all the damp air into one side of the pit, where a tube, of about 2 inches square, was closely fixed, one end of it into the hollow behind the framing, and the other carried up into the open air, 4 yards above the top of the pit: and thro' this tube the said damp air has ever since discharged itself, without being sensibly diminish'd in its strength, or lessened in its quantity, since it was first open'd, which was 2 years and 9 months. It is just the same in summer as in winter, and will fill a large bladder in a few seconds, by placing a funnel at the top of the tube, with the small end of it put into the neck of the bladder, and kept close with one's hand. The said air, being put into a bladder, and tied close, may be carried away and kept some days, and being afterwards press'd gently thro' a small pipe into the flame of a candle, will take fire, and burn at the end of the pipe, as long as the bladder is gently press'd to feed the flame, and when taken from the candle, after it is so lighted, it will continue burning, till there is no more air left in the bladder to supply the flame. This succeeded in *May* 1733 before the *Royal Society*, after the air had been confined in the bladder for near a month. The air, when it comes out at the top of the tube, is as cold as frosty air.

It is to be observed that this sort of vapour, or damp air, will not take fire except by flame; sparks do not affect it, and for that reason it is frequent to use flint and steel in places affected with this sort of damp, which will give a glimmering light, that is a great help to the workmen in difficult cases. After the damp air was carried up in a tube, in the manner above described, the pit was no more annoy'd with it, but was sunk down very successfully thro' the several beds of stone and coal, without any other accident, or interruption, till it came

to

to the main seam of coals, which is 3 yards thick, and 79 fathom deep from the surface; and the said pit being oval, *viz.* 10 foot one way, and 8 the other, it serves both for draining the water by a fire-engine, and also for raising the coals.

A solar Eclipse *observed in* Fleetstreet, London, *on* May 2. 1733, *in the afternoon; by Mr.* George Graham. Phil. Trans. N° 429. p. 113.

THE observation was made with a 10 foot telescope, fitted with a micrometer.

App. Time. H.	′	″	
5	44	45	The eclipse began.
6	25	30	The cusps were vertical.
6	37	30	The eclipse was greatest, the lucid part of the sun's diameter measuring 426 parts, whereof the sun's diameter measur'd 2311: So that the eclipse was 9 dig. $\frac{4}{5}$.
6	46	0	The cusps were horizontal.
7	28	23	The eclipse ended.

The same Eclipse *observed at* Norton-court; *by Mr.* Gray; *At* Otterden-place, *both in* Kent; *by Mr.* Wheeler; *and at* Yeovil *in* Somersetshire; *by Mr.* Milner. Phil. Trans. N° 429. p. 114.

MAY 2, 1733, Mr. *Gray* observed the eclipse of the sun at *Norton Court* near *Feversham* in *Kent*, as follows.

Appar.

		Appar. Time.			
		H.	′	″	
Obſervations	1	5	49	15	the beginning of the eclipſe.
	2	5	53	15	1 dig. eclipſed.
	3	5	57	30	2 dig.
	4	6	2	55	3 dig. $\frac{3}{4}$.
	5	6	11	50	5 dig.
	6	6	16	43	6
	7	6	21	7	7
	8	6	27	0	8
	9	6	32	45	9
	10	6	37	30	9 $\frac{1}{2}$.
	11	6	40	0	9 $\frac{7}{8}$ greateſt.
	12	6	56	56	8
	13	7	0	35	7 $\frac{5}{6}$.
	14	7	7	0	6
	15	7	11	55	5
	16	7	17	0	4
	17	7	21	15	3
	18	7	25	55	2
	19	7	32	30	End.

The obſervations were made with a helioſcope, or inſtrument conſiſting of a teleſcope and box with a digit ſcheme at the end of it: The teleſcope was 6 feet, the box 2 feet in length, and the ſun's image on the ſcheme was 6 inches and 8 tenths in diameter. The clock was rectified on the day of the eclipſe, and verified, ſo as to need no correction for ſeveral days afterwards, by obſervations of the ſun on the meridian. The ſun's tranſit was taken by the paſſage of its rays thro' a hole made in a braſs plate, the centre of which hole was at 6 feet and 3 inches perpendicular height above the horizontal plane on which the meridian line was drawn.

At *Otterden-place*, near *Lenham* in *Kent*, Mr. *Wheeler* obſerved the beginning at $5^h\ 49'$, and the end at $7^h\ 31'\ 49''$. His obſervations were made with a teleſcope 15 foot in length, and the time was alſo rectified by a meridian line; but it was done by a tranſit of the rays thro' a hole at a much greater height. For, the braſs plate in which the hole was made was fixed to a window in the roof of his hall, at the height of 27 feet above the meridian line on the floor.

At

At *Yeovil* (being in Lat. 51°) Mr. *Milner* obſerved the ſame ſolar eclipſe *May* 2, with a quadrant of 2 foot radius.

The beginning at	5^h	34′	0″	17°	45′	⎫
The middle at	6	0	0	13	36	⎬ ſun's altitude.
The end at	7	14	30	2	45	⎭

Some Eclipſes *of* Jupiter's Satellites *obſerved at* Bononia; *by M.* Manfredi. Phil. Tranſ. N° 429. p. 117. *Tranſlated from the* Latin.

True time.

April 2, 1732.

H.	′	″	
10	56	3	An emerſion of *Jupiter's* ſecond ſatellite, (the ſky being ſerene) with a 22 foot teleſcope.
13	2	39	An emerſion of the 4th ſatellite out of *Jupiter's* ſhadow, with a 22 foot teleſcope, the ſky ſerene.

April 3.

7	31	40	An emerſion of the innermoſt ſatellite with a 22 foot teleſcope, the ſky ſerene.

April 9.

13	32	4	An emerſion of the ſecond ſatellite with a 22 foot teleſcope, the ſky ſerene; ſomewhat dubious.

May 3.

9	44	41	An emerſion of the innermoſt ſatellite with a 22 foot teleſcope, the ſky ſerene.

May 4.

10	35	32	An emerſion of the ſecond ſatellite, with a 14 foot teleſcope, the air foggy, and the wind blowing.
10	35	41	With 11 foot teleſcope.

May 26.

9	58	4	An emerſion of the innermoſt ſatellite with a 22 foot teleſcope, the ſky ſerene.

True

True time. H.	'	"	
9	58	21	With 11 foot telescope.
			June 2.
9	43	47	An emersion of the third satellite with a 22 foot telescope, the air foggy.
			June 9, 1732.
11	7	24	An immersion of *Jupiter*'s third satellite with a 22 foot telescope, the sky serene.
			June 18.
10	8	25	An emersion of *Jupiter*'s innermost satellite with a 22 foot telescope, the sky serene.
			July 27.
7	36	5	An emersion of the innermost satellite with 11 foot telescope; sky serene; dubious.
			Jan. 17, 1733.
14	8	45	An immersion of the third satellite into *Jupiter*'s shadow with a 22 foot telescope, the sky serene.
14	8	33	With a 14 foot telescope.
16	13	29	An emersion of the third satellite with a 22 foot telescope, the sky serene.
			March 12.
13	23	34	An immersion of the innermost satellite into *Jupiter*'s shadow with a 22 foot telescope, the sky serene.
13	23	22	With a 11 foot telescope.

An

An Account of a remarkable Generation of Insects, *an* Earthquake, *and an explosion in the* Air, *in* Maryland; *by Mr.* Richard Lewis. Phil. Transf. N° 429. p. 119.

ABOUT the latter end of *June*, 1732, Mr. *Lewis* procur'd some leaves of the fly-tree (so called from the vast swarms of flies observed to issue therefrom) on which were fixed little tough bags, as big as the husk of a filbert, of a dusky green colour: Upon cutting them open, a fly, like a gnat, would come out; and he could discover no more, till viewing them with a glass, he could discern something moving amongst the bluish pulp; and after some time he observed it contained several red grubs, very small, and without wings; he bound up the *nidus*, and next morning the grubs had gotten bluish wings, with their body of a greyish colour; they were very numerous and soon flew away: Both the bark and leaf of the tree resembled a male mulberry. Amongst all the excrescencies Mr. *Lewis* had seen on leaves, he observed none like these. When the leaf is small these bags are scarce discernible; they grow with the leaf, which is neither discolour'd nor crumpled by them. *Redi*, in his curious treatise of the generation of insects, gives no account of any such nests.

On *Tuesday* the 5th of *Sept.* 1732, about 11 in the morning, an earthquake was felt in divers places in *Maryland*: One Mr. *Chew* had his house shook by it for some time, and the *pendulum* of his clock stopped: During its continuance, a rumbling noise was heard in the air; and both those who did, and those, who did not feel the shaking, complained of a dizziness in their heads, and sickness at their stomachs, it was felt at the same time in *Pensylvania*, and *New-England*; but whether it extended to north or south *Carolina*, was not said.

Mr. *Lewis* had the following account from Capt. *Smith* of a surprising phenomenon that happened in 1725, something of the nature of the abovemention'd earthquake, but with some remarkable difference: *Oct.* 22, 1725, about 2 in the afternoon, the sky being very serene and clear, Capt. *Smith* heard, as he then thought, the report of a gun, of a minion size, about 12 miles eastwards from him; this noise was repeated at least 20 times, but at unequal intervals; and was soon after follow'd by a very loud explosion, as if a ship had been blown up: Upon enquiry, he was told by several persons who liv'd about 12 miles from his house, that they were greatly surprised with the appearance of an extraordinary brightness in the zenith,

zenith, resembling flame, and continuing for about five minutes; after which these imaginary guns were fired off 20 or 30 times, disturbing the atmosphere in such manner, that the birds lost the use of their wings, and fell to the ground in great disorder. This noise was heard about 50 miles off each way from the aforesaid bright appearance. *Thus far the Captain.* Mr. *Lewis* heard the noise (as most other people did) but did not see the brightness at *Patapsko*, about 60 miles from the Captain's house. He was told that the shock, occasioned by the noise, threw down pewter that was set to dry against the side of a house.

An Account of some Children inoculated at Haverford-west *in* Pembrokeshire; *by Mr.* Evan Davis. Phil. Trans. N° 429. p. 121.

THE method of inoculating for the small-pox was about ten years before first introduced into *Haverford-west* in *Pembrokeshire* by the ingenious and learned Dr. *Perrot Williams*, who had then his own children inoculated among some of the first on whom the experiment was made; and an account of this was afterwards published in the *Philosophical Transactions*. About the beginning of spring 1732, this method of inoculation was a second time practis'd in the town of *Haverford-west* and the neighbourhood thereof, by two surgeons of good note and repute, and the only persons Mr. *Davis* heard of in these parts, who were come into that practice, and who gave him the following account: But in this second attempt, the measles interfering with the inoculated small-pox, and prolonging the time between the inoculation and eruption, so much beyond what otherways is usual, as may be observ'd in every one of the instances mentioned, has, he thinks, something in it peculiar and uncommon, and therefore worth the taking notice of.

Some little time before *Christmass* 1732 the small-pox, chiefly of the confluent kind, appear'd in *Haverford west*: Some had them with purple spots, and other violent symptoms, of which several died. Towards the spring the measles became more epidemical, and likewise more fatal than the small-pox. Some of the subjects that had been visited but a little before with the small-pox, and who upon their recovery had their bodies purged, died, notwithstanding of the violent cough that attended and succeeded the measles which afterwards siezed them. The measles continued to rage

rage, till almoſt all the ſubjects in the place were viſited with them, the ſmall-pox, continuing alſo during the whole time, yet making but ſlow progreſs, did not leave them till *Auguſt* following.

About the end of *Feb.* 1732, Mr. *Francis Meyler* inoculated his own ſon, about three years of age, with the *pus* from a child of about the ſame age, who had the diſtinct kind, but the puſtules ſmall. He made a ſlight inciſion on both legs, but it took only in one: After four days a puſtule appear'd on the wounded part, but did not much inflame it, nor make great progreſs. On the ſeventh day the child grew feveriſh; and on the eighth, or towards the ninth day (inſtead of the intended ſmall-pox) the meaſles appear'd all over his body, attended with a cough; at which time the feveriſh diſorder abated, till the 11th or 12th day: Then he grew feveriſh again, and towards the 14th day the ſmall-pox appear'd, a ſmall diſtinct ſort, and few in number: After the eruption was full, he grew hearty, and continued ſo, without a ſecond fever. After this Mr. *Meyler* inoculated two other children with the matter from his own ſon, by applying it after a ſlight inciſion, to both the legs of each of them, but it did not ſucceed. About the ſame time he inoculated two other children, a little way out of town, from a neighbour's child, but neither of them were infected: And whether this was owing to the ſlightneſs of the inciſion, or to the want of a ſufficient quantity of the variolous matter, or to a defect of diſpoſition in the ſubjects to be infected, he could not ſay; yet all the four eſcaped both the meaſles and ſmall-pox in the natural way.

About the latter end of *March*, 1732, Mr. *Richard Wright* inoculated a daughter of Mr. *Keymer* of *Haverford-weſt*, between three and four years of age, from another child of about the ſame age, who had the diſtinct kind. The matter was applied to one of her arms, the inciſion being made pretty deep. The inflammation began about the fourth or fifth day, and afterwards appear'd very conſiderable. She proceeded till the ſeventh day in a very hearty and briſk ſtate, at which time ſhe began to grow heavy, ſick, and very feveriſh. Then an eruption of the ſmall-pox was expected; but her fever increas'd, and the next day eruptions were obſerv'd all over her body, which prov'd to be the regular meaſles. She was treated accordingly, and grew well, excepting a pretty ſevere cough ſhe had, which continued thro' the whole courſe of the following ſmall-pox. About the twelfth day ſhe ſicken'd again, and about the 14th the ſmall-pox appear'd, of the diſtinct ſort, and very favourable; they came out, filled, and dried away very kindly, and were attended with very little of a ſecond fever. She went thro' the diſtemper with a great deal of chearfullneſs: She was purged afterwards, and ſeemed very well; but in a little time after, a boil broke out on the lower part of the ſhoulder-blade of the ſame arm in which ſhe was inoculated, which was brought to ſuppurate, and heal'd in the common manner. From this laſt mentioned ſubject Mr. *Wright* inoculated two daughters and a ſon of Mr. *Roch*, about five miles out of town. Theſe three children were from three to eight years of age. The inciſion was made in one arm of each child; it produced the ſame effect on every one of them, as it had done on Miſs *Kymer*; *viz.* the meaſles on the ſeventh or eighth day, and the ſmall-pox of the diſtinct kind on the 14th. They went all three very well thro' every ſtage of the diſtemper, and the ſecundary fever was but ſlight. One of theſe had them ſomewhat thick, and the other two had a pretty many of them; but they all thoroughly recover'd, and continued in a good ſtate of health ever after.

The ſafety and ſucceſs with which this practice is attended, ſeem to Mr. *Davis* to recommend it as a happy expedient, with which a kind providence has furniſhed us to guard againſt the injuries and dangers of one of the moſt dreadful and deſtructive diſeaſes, incident to mankind.

Obſer-

Observations of the Variations of the Needle and Weather in a Voyage to Hudson's Bay, *in* 1731, *by Captain* Christopher Middleton. Phil. Transf. N° 429. p. 127.

Months and Days.	Hours.	Height. Barom.	Height Therm.	Lat. *p.* *Davis* or Acc	Lat. *p.* *Elton.*	Obs.	Long.
1731	9						
June 14	12	30	26	59. 17			5d.52
	9						
15	9	32	25 ½				
	12	31	25 ½		59.24	Obs.	8d.58
	9	32	24 ¾				
16	9	32	24 ¾				
	12	32	24.3	59.33			11.50
	9	32	24 ½				
17	9	31	24				
	12	31	24 ½	59.35			15.10
	9	31½	24				
18	9	31	24				
	12	30	24	59.29			18.45
	9	29	23				
19	9	31	25				
	12	31	25	58.54	58.52	Obs.	21.15
	9	30	24				
20	9	30	24	Acc.			
	12	30	24 ¼	58.47	58.55	Obs.	24.11
	9	29	24 ½				
21	9	27	24 ½				
	12	26	24	58.47			29.13
	9	25	24				
22	9	25	24	Acc.			
	12	24	23 ½	58.42	58.47	Obs.	32.54
	9	24	23 ½				
23	9	26½	25				
	12	28	25	58.38			36.55
	9	30	26 ¼				
24	9	30	26 ¾				
	12	29	25 ½	58.37		Obs.	40.56
	9	28	25 ½				
25	9	28	25 ¾				

Months

Months and Days.	Hours.	Need. Variat.	Obſ.	Winds.	Weather.
1731	9			ENE.	
June 14	12	17.30		SE.	Fair and cloſe.
	9			SE b E.	Dit.
15	9				Fair and cloſe.
	12	18.		ESE.	Dit.
	9			Dit.	Dit.
16	9			ESE.	Dit.
	12	19.		Dit.	Dit.
	9			Dit.	Dit.
17	9			SE b S	Dit.
	12	20		Dit.	Dit. -- at two ſmall rain.
	9			S b W.	Dit.
18	9			SW.	Cloudy with ſmall miſt.
	12	21.		SW b S.	Foggy, with ſmall rain.
	9			NNW.	Fair and clear, but cloudy.
19	9			Dit.	Clear, with clouds.
	12	21. 30		Dit.	Hazy, with ſmall rain.
	9			N b E.	Fair and clear.
20	9			SE.	Clear, with ſmall rain.
	12	22.		Dit.	Fair and cloudy.
	9			SE b S.	Foggy, freſh gales and rain.
21	9			SE.	Freſh gales, with much rain.
	12	24.		Dit.	Ditto.
	9			Dit.	Little wind and foggy.
22	9			ESE.	Dit. -- with ſmall rain.
	12	26.	Obſ.	SE b E.	Foggy.
	9			ESE.	Dit.
23	9			NE b E.	Freſh gales, hazy and miſty.
	12	26.		ENE.	Ditto.
	9			Dit.	Freſh gales, with clouds.
24	9			ESE.	Fair, with little winds.
	12	27.30		Dit.	Ditto.
	9			Dit.	Ditto.
25	9			E b S.	Light winds and fair weather.

Months and Days.	Hours.	Height Barom.	Height therm.	Lat. *p. Davis*, or Act.	Lat. *p. Elton.*	Obs.	Long.
1731							
June 25	12	27	25	58.32		Obs.	43.
	9	28	25¾				
26	9	32	28				
	12	34	29	57.39			43.17
	9	31	27				
27	9	33	28				
	12	33	28	58.6			45.10
	9	31	27				
28	9	29	28				
	12	29	29	58.18			47.16
	9	32	29½				
29	9	33	29½				
	12	33	29	58.29			47.41
	9	32½	28½				
30	9	30	28½				
	12	29	28¾	58.53			51.16
	9	28	29½				
July 1	9	27½	30½				
	12	31	30½	59.49			54.56
	9	32	30½				
2	9	32	30				
	12	32	28¾	60.16	60.16	Obs.	55.4
	9	32½	29				
3	9	33	30				
	12	33½	31	60.08			56.22
	9	33	30½				
4	9	31	29½				
	12	30	29	59.33	59.33	Obs.	58.10
	9	29	28½				
5	9	33	29				
	12	31	28½	59.33			58.28
	9	31	28¾				
6	9	31	28				
	12	31	29	60.2			58.40
	9	31½	29				
7	9	31	30½				
	12	31½	30	60.9			60.22
	9	30½	29				

Months and Days.	Hours.	Need.	Variat.	Obs.	Winds.	Weather.
1731 June 25	12	30.		Obs.	E b S.	Fair and clear.
	9				N N W.	Cloudy.
26	9				W N W.	Close.
	12	29.			W b N.	Hazy.
	9				S W.	Fresh gales and hazy.
27	9				N W.	Foggy.
	12	30.			N W b N.	Thick and foggy.
	9				S E.	Hazy, with small rain.
28	9				S S E.	Foggy, with much rain.
	12	31.			S W.	Hazy, with small rain.
	9				W S W.	Fresh gales, with fogs.
29	9				W S W.	Little wind, and hazy.
	12	31.			S W.	Fair and clear; some rain.
	9				S S W.	Foggy and wet.
30	9				S b W.	Squally.
	12	33.			Dit.	Fresh gales. and hazy.
	9				S W.	Fresh gales, fogs, and rain.
July 1	9				W b S.	*Mer.* 2 $\frac{1}{2}$ D. above chan. stormy
	12	34.			West.	-- fell 1 D. below chang. mod.
	9					-- fell. small rain and hazy.
2	9				Calm.	Calm. Somewhat hazy.
	12	34.			Calm.	-- at a stand, fair and calm.
	9				Dit.	-- somewhat fall. light & clear.
3	9				North.	Close and grey weather.
	12	34.			N b E.	-- contin. to fall, clear & cold.
	9				North.	-- rising a little, fair and clear.
4	9				N N W.	-- rising, fair with fly. clouds.
	12	37.		Obs.	N W.	-- rising, lit. wind, & sm. rain.
	9				North.	Close lit. winds and fly. clouds.
5	9				N W b N.	Light air and variable.
	12	37.			Calm.	-- fallen, fair and clear.
	9				Dit.	-- at a stand, fair weather.
6	9				N N W.	--at a stand, close, and lit. winds
	12	37.			N N W.	-- at a stand, little winds.
	9				N E.	-- at a stand, close & cloudy.
7	9				N N E.	-- some fall. clear w. clouds.
	12	37.	40		Calm.	Close and grey weather.
	9			Obs.	S W.	-- rising, little wind and hazy.

Months and Days.	Hours.	Barom. Alt.	Therm. Alt.	Lat. *p.* *Davis.* or Ac.	Lat. *p.* *Elton.*	Obs.	Long.
July 8	9	31	29 1:2				
	12	31	30	60.29	60.30	Obs.	61.23
	9	31	29				
9	9	34	34				
	12	34	33 1:2	61.16	61.19	Obs.	63 57
	9	33	32				
10	9	32	32	Acc.			
	12	32	32	61.35	61.25	Obs.	65.17
	9	32	32				
11	9	34	33 1:3	Acc.			
	12	34	33 1:3	62	62.4	Obs.	69.2
	9	34	33				
12	9	37	32 1:2				
	12	36	30 1:2		62.33	Obs.	71.2
	9	35	30				
13	9	35	29 1:2	Acc.			
	12	35	30	62.46	62.40	Obs.	72.6
	9	35	30 1:3				
14	9	35	32				
	12	35	32	62.30		Obs.	73.33
	9	35	32				
15	9	34 1:2	32	Acc.			
	12	35	33 1:2	63.13	63.14	Obs.	75.9
	9	35	33 1:2				
16	9	35	33	Acc.			
	12	35	32	63.21	62. 58	Obs.	77.3
	9	35 1:2	31 1:2				
17	9	34 1:2	31				
	12	33 1:2	30 1:2	63.17			78.29
	9	33	30 1:2				
18	9	33 1:2	31	Acc.			
	12	34	31 1:2	63.9	63.6	Obs.	79.53
	9	34	31 1:2				
19	9	33 1:2	31 1:2				
	12	33	30 1:2	62.14		Obs.	80.44
	9	30 1:2	29				
20	9	28	27				
	12	28	26 1:2	61.18			81.26
	9	30	29				
21	9	32	30				
	12	32	29	60.5		Obs.	83.2
	9	32	29 1:2				
22	9	34	31				

Months

Months and Days.	Hours.	Variat.	Obs.	Winds.	Weather.
July 8	9			S E.	Close and foggy.
	12	38		N E.	Dit.
	9			W b N.	Dit.
9	9			S W b S.	*Mer.* fallen 4 deg. clear and cold.
	12	38	Obs.	Dit.	Fair, clear, much ice in sight.
	9				— rising, fair and clear.
10	9			S S E.	— rising, fair and clear.
	12	40		Dit.	— at a stand, fair and clear.
	9				— stands, fresh gale.
11	9			S E b S.	— fallen, fresh gales with squalls.
	12	41		S E b S.	— at a stand, fresh gales.
	9			Dit.	— at a stand, hazy.
12	9			Dit.	— fallen, fair.
	12	43		W S W.	— somewhat rising, fair.
	9			Dit.	— rising, little winds, and fair.
13	9			Dit.	— at a stand, fair with calm.
	12	43		N W.	Fair and moderate.
	9			N W.	Fair and clear.
14	9			Dit.	— at a stand, fair and clear.
	12	41		North.	— at a stand, fair and clear.
	9			N W b N	Fair, serene weather.
15	9			South.	— somewhat fallen, foggy.
	12	41		S b E.	Very foggy.
	9			S E.	— at a stand, foggy.
16	9			N W.	— at a stand, fair and clear.
	12	42		N N W.	Fair, serene weather.
	9			Dit.	— falling, clear.
17	9			N W.	— rising, clear.
	12	41		Dit.	— continues rising, clear.
	9			North.	— rising, serene weather.
18	9			N W.	Foggy.
	12	40		Dit.	— a little fallen, thick fog.
	9			South.	— at a stand, hazy.
19	9			East.	— rising, fresh gale.
	12			E b N.	— continue rising, fair and clear.
	9			Dit.	— continues rising, serene.
20	9			West.	— rising, grey close weather.
	12	37		Dit.	— stands, fresh gales and foggy.
	9			N W.	— fallen, hazy.
21	9			North.	— falls, fair and clear.
	12	34		N W.	— stands, fresh gales, and fair.
	9			Dit.	— at a stand, squally.
22	9			N W.	— fallen, moderate, and fair.

Months and Days.	Hours.	Barom. Alt.	Therm. Alt.	Lat. *p.* *Davis*, or Act.	Lat. *p.* *Elton.*	Obſ.	Long.
July 22	12	34	31	58.4		Obſ.	84.20
	9	33	31				
23	9	32	31				
	12	32 1:2	31 1:2	57.35			84.20
	9	33	32				
24	9	37	34	Acc.			
	12	37	33 1:2	56.13	56.20	Obſ.	85.27
	9	36 1:2	32 1:2				
25	9	36	32	Acc.			
	12	35	31 1:2	56.24	56.24	Obſ.	85.27
	9	35	32 1:2				
	9	35	33 1:2				
July 26	12	36	33 1:2	55.39		55.33	85.40
	9	36	34				
27	9	37	35				
	12	37	34 1:2	54.23			85.48
	9	37	35				
28	9	37	34 3:4				
	12	37	34 1:2	53.57			
	9	35	30				
29	9	35	30 1:2				
	12	34	31	53.29			
	9	33	31				
30	9	37	32				
	12	36	29				
	9	35	29 1:3				
31	9	31	27				
	12	31	27				
	9	29	25				
Aug. 1	9	26	22				
Aug. 20	9	30	35				
	12	33	27	52.40		52.42	
	9	35	30				
21	9	36 1:2	30				
	12	37	31	52.54	52.55		
	9	37	30 1:2				
22	9	36	28				

Months and Days.	Hours.	Variat.	Obſ.	Winds.	Weather.
July 22.	12	30		Weſt.	*Mer.* at a ſtand, fair.
	9			W S W.	—— riſes, dark and cloudy.
23	9			W b N.	—— riſing, dirty and rain.
	12	29		W b S.	—— ſtands, foggy, and ſmall rain.
	9			N W.	—— fallen, freſh breeze and cold.
24	9			N W.	—— fallen 4 deg. incloſ'd with ice.
	12	25		Weſt.	—— ſtands, foggy and much ice.
	9			Calm.	—— riſing, ſerene.
25	9			S S E.	—— riſing, hazy.
	12	24		Eaſt.	—— continues riſing fair.
	9			S EbE.	—— ſtands hazy, and cold air.
	9			S S E.	—— ſomewhat fallen, hazy, and cold.
26	12	24		N b E.	*Mer.* falling rain, and freſh gales.
	9			N N W.	—— ſtands, thick and rainy.
27	9			E N E.	—— continue falling, fair and cold.
	12	24		E b N.	—— ſtands cold, and much ice.
	9			N b E.	—— as above, freſh gale, cold.
28	9			N b W.	—— as above, moderate and hazy.
	12	24		N N W.	—— ſtands, moderate and fair.
	9			S W.	—— riſing, fair, pleaſant weather.
29	9			S W b W.	—— at a ſtand, cloudy weather, rain.
	12	25		S W.	—— riſing, thunder and rain.
	9				—— riſing, freſh gales windy Rain.
30	9			N N W.	—— much fallen, moderate.
	12				—— riſing, fair and moderate.
	9				—— continue riſing, fair and ſettled.
31	9				—— riſing, ſqually, with rain.
	12				—— as above, fair and moderate.
	9				—— riſing quick, fair,
Aug. 1	9				—— continued riſing, warm and fair.
Aug. 20	9			W N W.	Hazy and moderate.
	12		Obſ.	N N W.	*Mer.* ſtands hazy.
	9			Dit.	—— ſtands, freſh gales.
21	9			North.	—— ſomewhat fallen, fair.
	12		Obſ.	North.	—— fallen.
	9			Dit.	—— falls clear, ſerene, and cold.
22	9			S W b W.	—— riſes, fair light bre[illegible]zes.

Aug.

Months and Days.	Hours.	Barom. Alt.	Therm. Alt.	Lat. perAccount.	per Davis.	per Elton.	Long.
Aug. 22	12	36	29	52.57	52.59		
	9	35	29				
23	9	34 1:2	29				
	12	34	29	53.54			
	9	33	30				
24	9	32	28 1:2				
	12	32	29	55.16			
	9	33	30				
25	9	34	30 1:2				
	12	35	31	55.48			
	9	34	31				
26	9	36	33				
	12	36	33	56.55	56.56	56.56	
	9	37	34				
27	9	40	34				
	12	40	34	58.14	58.13		
	9	40	34				
28	9	38	33				
	12	38	32	58.35	58.41		
	9	38	32				
29	9	37	31				
	12	37	30	59.24	59.33		
	9	36	30				
30	9	36	31				
	12	37	30	59.55	60.5		
	9	37	30				
31	9	39	35				
	12	40	37	59.55			
	9	40	37				
Sept. 1	9	40	36				
	12	40	36 1:2	59.25			
	9	41	36				
2	9	42	36 1:2				
	12	43	36 1:2	59.43	59.36		
	9	42	34				
3	9	41	35				
	12	40	35 1:2	60.40			
	9	35	35				
4	9	32 1:2	32 1:2				
	12	31	33	61.33			
	9	30	33				
5	9	34	33				
	12	37	35	62.12			
	9	38	35 1:2				
6	9	42	37				

Aug.

Months and Days.	Hours	Variat	Obſ.	Winds.	Weather.
Aug. 22	12		Obſ.	SWbW	*Mer.* ſtands, clear, and calm.
	9				—— ſomewhat riſen, calm.
23	9			S S E.	—— riſes, hazy.
	12			Dit.	—— continued riſing, freſh gales.
	9			S b W.	—— riſing, hazy, drops of rain.
24	9			S E.	Fair and moderate.
	12	25		S E.	Hazy.
	9			N E.	Hazy and cloſe.
25	9			N N E.	*Mer.* falls, foggy and cold.
	12	26		Dit.	—— continues fallen, cold.
	9			Dit.	—— little riſing.
26	9			E S E.	—— fallen, moderate, and fair.
	12	28	Obſ.	Dit.	—— ſtands, freſh gales.
	9			E b N.	Hard gales.
27	9			E N E.	—— fallen, freſh gales.
	12	29	Obſ.	Dit.	Hard gales.
	9			E N E.	—— ſtands, moderate.
28	9			N N E.	—— ſomewhat riſen, fair.
	12	30	Obſ.	North.	—— ſtands, fair and moderate.
	9			North.	Fair and calm.
29	9			Dit.	Fair and clear.
	12	31	Obſ.	N b W.	*Mer.* little riſen, fair.
	9			Weſt.	—— ſtands, fair weather.
30	9			Calm.	—— ſtands, variable.
	12	31	Obſ.	E S E.	—— ſomewhat fallen.
	9			E b N.	—— ſtands, ſqually.
31	9			E N E.	—— fallen, freſh gales.
	12	32		Dit.	—— continue fallen, fr. ga. & clou.
	9			Dit.	—— ſtands, ſqually.
Sept. 1	9			N E.	—— ſtands, great ſea.
	12	31		Dit.	
	9				
2	9			E N E.	—— fallen, flying clouds.
	12	32	Obſ.	Dit.	—— continue falling, moderate.
	9			N N W.	Moderate.
3	9			S W.	—— riſing, freſh gales.
	12	33		Dit.	—— continue riſing, hard gales.
	9			Dit.	—— riſing faſt, very hard gales.
4	9			Dit.	—— ſtill riſing, blowing very hard.
	12	35		Dit.	—— continues riſing, foggy.
	9			W S W.	Thick fog.
5	9			N b E.	*Mer.* fallen, freſh gales.
	12	38		Dit.	Freſh gales.
	9			Dit.	—— continues fallen, moderate.
6	9			N E b N.	—— ſtands, hazy, ſnow.

Months and Days.	Hours.	Barom. Alt.	Therm. .Alt	Lat. Acct.	Lat. *p. Davis.*	*per Elton.*	Long.
Sept. 6	12	42	36 1:2	62.37		62.49	
	9	42	36 1:2				
7	9	42	37				
	12	42	37	63.10		63.21	
	9	42	36 1:2				
8	9	41	36				
	12	41	35 1:2	63.25			
	9	41	35 1:2				
9	9	41	35				
	12	40	34 1:2	63.19		63.13	
	9	41	35 1:2				
10	9	42	37				
	12	42	38	62.48	62.30		
	9	43	38				
11	9	44	38				
	12	45	38 1:2	61.43			
	9	45	38				
12	9	44	37 1:2				
	12	42	36 1:2	61.31	61.29		
	9	41	36				
13	9	40 1:2	36				
	12	40	36	61.16	61.5		60.18
	9	40	36				
14	9	40	35 1:2				
	12	39	35	60.36			57.12
	9	38	35				
15	9	37	35 1:2				
	12	37 1:2	36	59.41	59.28		52.29
	9	37 1:2	35				
16	9	37 1:2	34 1:2				
	12	37 1:2	33 1:2	58.20	58.10		47.18
	9	37 1:2	33 1:2				
17	9	37	33				
	12	37 1:2	33 1:2	57.15			43.44
	9	37 1:2	33				
18	9	27	28 1:2				
	12	26	28 1:2	56.35	56.25		42.32
	9	26	28 1:2				
19	9	34	29				
	12	35	30	55.23	55.29		38.48
	9	35	31				
20	9	34	30 1:2				
	12	33 1:2	31	54.23			34.19
	9	33 1:2	31				
21	9	33	30				

Months and Days.	Hours.	Variat	Obf.	Winds.	Weather.
[S]ept. 6	12	42	Obf.	N E b N.	*Mer.* ftands, thick weather.
	9			S E.	—— the fame.
7	9				Continued hazy, with ledges of ice,
	12	42	Obf.	S E.	Dit.
	9			Dit.	The fame, fogs and freezing.
8	9			E S E.	*Mer.* fomewhat rifen, foggy.
	12	41		Dit.	—— ftands.
	9			Dit.	—— the fame, fair.
9	9			Calm.	—— the fame.
	12	40	Obf.	N W b W.	—— fomewhat rifen, fair.
	9			Dit.	—— fallen, fair.
10	9			N b W.	—— continues fallen, fair.
	12	41	Obf.	Dit.	—— the fame.
	9			Dit.	—— fallen, fair.
11	9			Dit.	—— fallen, fair.
	12	40		Dit.	—— continued fallen, fair and cold.
	9			North.	—— at a ftand, fair.
12	9			W N W.	—— rifen, fair.
	12	40	Obf.	Weft.	—— rifen, hazy with much ice.
	9			Dit.	—— rifing, fair and clear.
13	9			N W.	Fair.
	12	38	Obf.	Dit.	Fair and moderate.
	9				*Mer.* the fame, cloudy.
14	9			N W.	—— the fame fair.
	12	38		Dit.	Fair and cloudy.
	9			N W b N.	—— rifing, hazy, with fnow.
15	9			N N E.	—— rifen, foggy.
	12	35	Obf.	Dit.	Fair.
	9			N W.	
16	9			Weft.	—— ftands, cloudy.
	12	33	Obf.	N W b W.	—— the fame, cloudy.
	9				—— ftands variable.
17	9			N N W.	—— the fame, cloudy.
	12	29		Dit.	—— fomewhat fallen, cloudy.
	9			Dit.	Calm.
18	9			S W.	—— rifing quick, frefh gales.
	12	27	Obf.	Dit.	—— little rifing, cloudy.
	9			Weft.	—— ftands, fqually with rain.
19	9			N W.	Clear, with frefh gales.
	12	25	Obf.	Dit.	—— ftill falling, fair.
	9			Dit.	—— ftands, fair, fqually.
20	9			W N W.	—— rifing, fqually with hail.
	12	22		Dit.	Hard fqualls.
	9				—— at a ftand. hard fqualls.
21	9				Squally with frefh gales.

Months and Days.	Hours.	Barom. Alt.	Therm. Alt.	Lat. Acct.	Lat. p. Davis.	per Elton.	Long.
Sept. 21	12	33	29 1:2	53.9			29.51
	9	34	29				
22	9	34	28 1:2				
	12	35	28	52.7	52.14		26.25
	9	30	25				
23	9	28	25				
	12	24	24				
	9	21	21				
24	9	22	22				
	12	22 1:2	22 1:2	52.30			23.12
	9	22 1:2	22 1:2				
25	9	21 1:2	22				
	12	21 1:2	22	51.50	51.54		20.24
	9	21	22				
26	9	21	21 1:2				
	12	21	21 1:2	50.38	50.46		17.12
	9	21	21				
27	9	22	21				
	12	23	20 1:2	49.28	49.28		13.26
	9	22	20				
28	9	20	19				
	12	19	18	49.15	49.2		9.21
	9	21	18 1:2				
29	9	23	18 1:2				
	12	22	18	49.32			5.18
	9	22	18				
30	9	22	18				
	12	22	18	49.18	49.30		
	9	22	18				
Oct. 1.	9	24	17				
	12	26	19	50.2			
	9	28	21				
2	9	29	21				
	12	29	21				
	9	30	22				

Months and Days.	Hours.	Need. Varia.	Obſ.	Winds.	Weather.
Sept. 21	12	20		N W.	*Mer.* ſtands, clear freſh gales.
	9			Dit.	—— ſomewhat fallen.
22	9			N b W.	—— ſtands, fair.
	12	19	Obſ.	N W b W.	—— fallen, clear.
	9			S W.	—— riſing quick, cloudy.
23	9			S b E.	—— ſtill riſing, hard gales.
	12			Dit.	—— riſing quick, thick and dirty.
	9				—— continues riſing.
24	9			Eaſt.	—— ſtands, cloudy and rain.
	12	17		Dit.	Dit. freſh gales.
	9			Dit.	—— at a ſtand, cloudy.
25	9			South.	—— riſing, ſqually and rain.
	12	16	Obſ.	Dit.	—— the ſame, freſh gales.
	9			W S W.	—— the ſame, ſqually with rain.
26	9			S W.	Fair, freſh breeze.
	12	16	Obſ.	S b W.	Fair and clear.
	9			Dit.	—— the ſame, freſh gales.
27	9			Weſt.	—— little fallen, fair and cloudy.
	12	15	Obſ.	Dit.	Fair.
	9			S W.	A great ſea, ſqually.
28	9			Dit.	—— riſing, freſh gales and rain.
	12	14	Obſ.	Dit.	—— continued riſing, freſh gales.
	9			W S W.	—— little fallen, fair weather.
29	9			S b W.	—— fallen, hazy, freſh gales.
	12	14		Dit.	
	9			S W b S.	—— at a ſtand, freſh gales.
30	9			Dit.	—— the ſame, hazy.
	12	14	Obſ.	S W.	—— at a ſtand, hazy.
	9				—— continued the ſame, ſqually.
Oct. 1.	9			Weſt.	—— fallen, fair and clear.
	12	14		W S W.	—— continues fallen, fair.
	9			Dit.	—— fallen, fair and clear.
2	9			Dit.	
	12			Dit.	—— continues, pleaſant.
	9			Dit.	—— the ſame, fair and clear.

As to Mr. *Patrick*'s marine-barometer, which Captain *Middleton* made uſe of for two voyages to *Hudſon*'s bay in *North America*, by the ſtricteſt obſervations, he always found it to give him timely notice of all bad weather, and likewiſe of veerable winds; as alſo certain intelligence of their coming nigh any ice, with the quantity they had to go thro'. It is an inſtrument of excellent uſe, he having continually found himſelf obliged to conform to its more certain information preferable to all other ocular appearances in the horizon. He likewiſe obſerves, that when they came in, or near ice, they were obliged to keep one of their compaſſes continually moving, there being either ſome magnetic particles in the air, or ſome other quality that hinders them from traverſing; which makes the courſe very difficult to traverſe: This happens generally in entring *Hudſon*'s ſtreights and bay, but never ſo without being near or amongſt ice. He enquired of the Commanders, and others that uſe *Greenland* and *Davis*'s ſtreights, and finds great complaints from them of their compaſſes not traverſing. Captain *Middleton* tried the needle of the azimuth compaſs without the chart, and finds it to traverſe much better; ſo that he deſigned to have iceing-glaſs charts, as being lighter.

An Obſervation of a total Eclipſe of the Sun, *with a* Mora, *at* Gottenburg *in* Swedland, *in Lat.* 57° 40′ 54″, May 2 1733, *O. S. by M.* Birger Vaſſenius. Phil. Tranſ. N° 429, p. 134. *Tranſlated from the* Latin.

THE beginning of the eclipſe, which could not be obſerv'd by reaſon of clouds, ſeems to have happened before 6h 26′ in the afternoon.

H.	′	″	
6	38	43	The ſun was eclips'd three digits nearly.
6	49	52	About ſix digits.
7	14	6	*Jupiter* appear'd.
7	14	46	The entire diſk of the ſun begins to be cover'd.
7	15	50	A very great darkneſs, when all the ſtars of *Urſa Major*, *Cor Leonis*, *Sirius*, *Procyon*, the *Bull's eye*, and ſome others might be ſeen; yet neither *Mercury* nor *Mars* appear'd.
7	16	54	The ſun began to dart forth his rays with incredible ſwifrneſs.
7	20	12	*Jupiter* ſtill appear'd.
7	41	38	Six digits of the ſun covered.

H.

H.	'	"	
8	5	50	The end of the eclipſe, the entire disk of the ſun ſhining.
			The *mora* of the total eclipſe at *Gottenburg* was 2′ 8″.
			The *mora* of the ſame eclipſe in a place call'd *Swenaker*, ſeven *Swediſh* miles from *Gottenburg* to the north, in Lat. 58° 15′, (as M. *Torſtanus Vaſſenius* obſerv'd by means of a pendulum) was 2′ 31″.

At the time of the total eclipſe M. *Birger Vaſſenius*, with a teleſcope about 21 *Swediſh* feet in length, did, beſides the greateſt part of the *maculæ* on the ſun's disk, obſerve the moon's atmoſphere; which at the time of the greateſt immerſion was a little brighter at the weſtern limb; yet without that irregularity and inequality of luminous rays, that appear'd to the naked eye. What was very remarkable was three or four reddiſh *maculæ* obſerv'd without the periphery of the moon's disk; one of which was bigger than the reſt, in the middle between ſouth and weſt nearly as far as could be conjectured: It was compos'd of three parts, as it were, or leſſer parallel *nubeculæ* of unequal lengths, with ſome little obliquity to the moon's periphery.

This ſpot, or rather cloud, retain'd invariable its priſtine ſituation in the atmoſphere near the moon's periphery for upwards of 40″. But at length a ray of the ſun, like lightning, emitted on the moon's northern limb, deprived him of this agreeable ſight.

An Account of an Experiment relating to the Force of Moving Bodies, contriv'd by M. S'Graveſande, *and ſhewn to the Royal Society by Dr.* Deſaguliers. Phil. Tranſ. N° 429. p. 143.

DR. *Deſaguliers* having ſhewn ſeveral perſons in *Holland* the experiment contriv'd by Mr. *George Graham*, to explain the doctrine of the *momentum* of bodies (*viz.* that the *momentum* or quantity of motion in bodies is always as the maſs multiplied into the velocity) which experiment is made with a flat pendulous body, that receives the addition of a weight equal to itſelf at the lower part of its vibration, and by the reception of that equal quantity of matter always loſes half its velocity; Dr. *Muſchenbroek* communicated the following experiment made by M. *S'Graveſande* in oppoſition thereto:

thereto; *viz.* a ſpring, equally bent every time, puſhes forward unequal quantities of matter ſucceſſively, and in every experiment the product of the maſs of the body by the ſquare of the velocity is the ſame; and therefore, as the quantity of motion muſt always be the ſame from the ſame cauſe (*viz.* the ſame tenſion of the ſpring) it follows, by every experiment, that it is as the maſs multiplied into the ſquare of the velocity.

Experiment 1. The pendulous cylinder is ſhot by the ſpring from 0 to 7 degrees, meaſur'd upon a tangent line.

Exp. 2. The cylinder, with a leaden weight therein, that makes its weight double, is ſhot forward to four degrees 9 tenths.

Exp. 3. The cylinder, with a weight therein, that made its weight triple, was ſhot forward to four degrees and a little farther.

Exp. 4. The cylinder, with a triple weight of lead, ſo as to quadruple the whole weight, was ſhot forwards to three degrees and a half.

Theſe four experiments ſeem at firſt agreeable to the new hypotheſis: For, according to the old, the cylinder in the ſecond experiment ought to have gone but to three degrees and a half; in the third but to three and one ſeventh; and in the laſt but to two degrees. But if we take in the conſideration of time, all will be reduced to the old principle. As for inſtance, let us compare the firſt and laſt experiments. In the firſt, the ſpring, during a certain time, acts upon the cylinder, which is driven forward with the velocity 8. When the quadrupled weight is driven forward with the velocity 4 inſtead of 2, it is becauſe the ſame ſpring acts twice as long upon the cylinder before it ceaſes to impel it; and certainly the ſame cauſe acting twice as long muſt produce a double effect.

Experiments on Mercury; *by Dr.* Boerhaave. Phil. Tranſ. N° 430. p. 145. *Tranſlated from the* Latin.

SUCH as have carefully applied themſelves to the inveſtigating by experiments the origin of corporeal things, their peculiar virtues and properties, ſuch only are poſſeſſed of the methods by which the true knowledge of them is with certainty obtain'd. But when the candid enumerate the inſtruments of this knowledge, they unanimouſly own, that chemiſtry affords the moſt uſeful, for vigorouſly promoting the

the deſign: And when they carefully peruſe the authors celebrated in the art, it plainly appears that the moſt ancient alchemiſts excel all others when they treat of the nature of things; of this *Geber*, and ſuch as immediately followed him, are pregnant inſtances: For, they ſimply deſcribe the things they diſcover by their art, to the ſole improving of which they wholly devoted themſelves: And indeed no ſet of men have made their reſearches into nature, with ſuch penetration, obſtinacy and indefatigable labour, as the alchemiſts: And what obſcurity ſoever they may affect in treating of the *Arcanum of the Wiſemen*, in their common inventions they are open and plain.

Upon peruſing the writings of chemiſts and alchemiſts, Dr. *Boerhaave* found that they all agreed in this; namely, that metals are naturally produced and nouriſhed; that they grow and multiply in their veins in the ſame manner, as other natural bodies do in their proper places; and likewiſe that the aliment of metals, which before was of a different nature, is by the genial virtue of the metallic ſeed converted into a true metallic nature; ſo as by this ſeminal virtue alone to loſe its priſtine nature and acquire this new one by the cheriſhing impregnating warmth alone: And this in the manner, as the ſeeds of animals and vegetables convert whatever they receive into their proper nouriſhment. Thus, the vivifying ſeed of vegetating gold, meeting with a fit *pabulum* in a proper *matrix* does by means of a ſuitable degree of heat digeſt it into its own peculiar nature. In this manner, therefore, they hold, that, by a law imprinted on ſubterraneous bodies, true gold is always produced by length of time from a matter of a differenr nature from itſelf. The more accurate enquirers have found, that growing metals, eſpecially gold, are cloſely pent up in hard and pure rock, which is ſo ſollicitouſly ſealed down, as not to admit of any viſible communication. The *matrix* or ore of the growing metal being denſe, hard, impenetrable, and cloſe, reſembles glaſs. Scarce any thing more unaccountable than the manner, in which ſolid metallic particles penetrate a ponderous maſs of hard flint, and reach into veins impregnated and charged with metal: Nor is it leſs difficult to account which way the ſaid metallic parts ſhould ſecretly paſs into them, if, as is very probable, they are originally in a liquid ſtate. The genuine matrix of metal thus known, the heat alſo of mines is known; which rarely equals that of a ſound perſon, but is fre-

frequently below the 60th degree in *Fahrenheit*'s thermometer. Hence the adepts order to include the pregnant matter of the *arcanum* in pure glaſs, and cheriſh it with a degree of heat equal to that of *May*, which by M. *Cruquius*'s accurate obſervations is 50 degrees, and is the mean degree of heat throughout the year. Both the *pabulum* of metals, as alſo that ſeminal, prolific, and generative matter, ſtill remain a myſtery.

The generality affirm that quickſilver is the common matter of all metals; which changed by the power of the vital ſeed, yields a determinate metal according to the peculiar property of the ſeminal efficacy; all metals, therefore, arrive to their reſpective perfect ſpecies by the mature concoction of quickſilver, and this metallific virtue, call'd ſulphur. Hence each ſpecies of metal is again reſolvable into theſe two. But an original impurity intimately adheres to quickſilver, which is confirmed as it grows up, and hence ſeparated from it with difficulty; and if freed from that heterogeneous impurity, a very difficult task, it at length becomes liquid, metallic, very ponderous, and ſimple, and neither diviſible by art or nature into different parts; in this the vivified ſeed of each diſſolv'd metal would be perfectly multiplied; and in it gold itſelf diſſolv'd, cheriſh'd, and brought to maturity, would be the ultimate effect of art, a thing ſo much ſought for, and ſo much cried up.

Upon obſerving that the adepts agreed on theſe things, the Dr. for a long time applied himſelf to diſcover how mercury might be obtain'd pure. Whether it could be got from metals? and what that other part is, that is apt to fix mercury.

1. Pure quickſilver, only ſhook in a dry, ſound glaſs-veſſel, yields a ſoft, black, fine powder.

Proceſs. Upon ſtraining thro' leather 16 ounces of quickſilver, no impurity remain'd behind: Having ground it for a long time with pure water, the water ſtill continued pure; and with ſea-ſalt, the colour of the ſalt was noways fouled; the triture was repeated after pouring water to the ſalt and mercury, nor thus was the colour changed: And the whole proceſs yielded neither blackneſs nor foulneſs: After waſhing and drying the mercury it became ſhining: He poured it into a bottle of green *German* glaſs, which he put into a ſand-heat, ſo as almoſt to bring over the mercury; and that for three days, till all the water, which often lies conceal'd

in

in mercury was entirely evaporated: The warm bottle was corked tight down, and ſealed with a cement of pitch, roſin, ſuet, and ſulphur; and the whole wrapped cloſe in a linnen cloth and ropes: In this manner he put the bottle into a wooden box, that juſt touched its ſides; and he filled up the vacuities with dry bran, that the bottle might ſtand firm; and faſtened on the top a wooden cover with a hole in the middle, that the neck of the bottle might ſtand out a little above it: And in this manner he caus'd tie it to the ſtamper of a fulling mill, that was always in motion when there was any wind: and from the 1ſt of *March* to the 13th of *Nov.* 1732, it was ſhook up and down, always in a perpendicular poſition.

Upon opening the bottle, he had the ſame weight of mercury, cover'd all over with a large quantity of a very ſoft black and fine powder. He ſqueezed it thro' clean leather, and a pure liquid mercury paſſed thro', and the powder remained behind of an acrid, metallic taſte, ſomewhat like that of copper.

Corollaries. 1. Quickſilver, which of itſelf is very inſipid, by only ſhaking it, becomes of a metallic, copperiſh taſte. 2. From very mild, it changes acrid and penetrating. 3. From a very bright ſilver colour it turns very black. 4. From a fluid it becomes conſiſtent under the appearance of a powder. 5. It may, theeefore, lie conceal'd under that form, and deceive the ignorant.

2. Highly purified quickſilver, treated in the ſame manner, yields a like powder in a much larger quantity.

Proceſs. From a ſuſpicion, that ſomething heterogenous might adhere to mercury, and by agitation be ſeparated therefrom under the form of a powder: With a glaſs retort in a ſand heat he diſtill'd all the mercury; and this he repeated 60 times more. In the bottom of the veſſel were five drachms of a red powder, of which anon. This mercury was exceeding volatile and ſhining. He caus'd ſhake two ounces of it at a fulling mill, in the ſame manner, and for the ſame time, as in proceſs 1.

Effect. The weight was the ſame. The powder obtain'd was ſoft, black, and of an acrid, metallic taſte, like copper; and two drachms, and 26 grains in quantity, which was more than $\frac{1}{8}$ of the whole; whereas mercury commonly ſold in the ſhops ſcarce yields $\frac{1}{2}\frac{1}{8}$.

 Cor.

Cor. 1. Mercury diſtill'd 61 times, gains from being very inſipid, a metallic taſte. 2. From very mild, becomes acrid, and penetrating. 3. From a very bright ſilver colour, changes very black. 4. From being more fluid than the native, becomes a conſiſtent powder. 5. It retains this property in a conſtant ſtrong fire, and ſeveral times repeated. 6. This property therefore, does not depend on any adventitious impurity ſeparable from it by fire. 7. The red ſhining acrid matter remaining at the bottom of the retort after diſtillation, is no more like the black matter obtain'd by ſhaking, than that part which continued volatile. 8. By fire, mercury changes red, and by ſhaking, it turns black; and it is of changeable colours. 9. Whether a ſmaller quantity of mercury yield a greater quantity of black powder?

3. If the black powder of proceſs 2 be urged with a ſtrong fire, it becomes pure mercury.

Proceſs. In a glaſs retort he urged with a ſtrong open fire, two drachms and 26 grains of the black powder of proceſs 2. So that at laſt for two hours the retort was glowing hot.

Effect. In the receiver were two drachms and two grains of a very pure, inſipid ſhining mercury: To the ſides of the glaſs, which joined to the retort, terminates in a veſſel full of water, there ſtuck here and there a ſmall quantity of mercury, which he could not entirely collect. In the bottom of the retort was a ſmall fixed ſtain, exceeding fine, and but juſt viſible.

Cor. 1. Mercury diſtill'd 61 times, agitated, and changed to the above-mentioned powder, does by the action of fire alone reſume its priſtine form. 2. From acrid, and penetrating, it turns very mild. 3, From a very black colour, it gains the ſilver brightneſs of a mirror. 4. From a conſiſtent powder it becomes very fluid. 5. By theſe three operations it continues the ſame in itſelf, but under various forms changes its ſpecies. 6. Its taſte and acrimony are ſurpriſingly alter'd, by ſhaking only, or by fire only. 7. By theſe operations ſomething fixed ariſes from mercury. 8. The black powder thus ſeparated from mercury was neither an impurity nor any thing heterogeneous.

Scholium. In conical glaſs bodies with flat bottoms, and ſtopped with inverted glaſs bolt-heads, he expoſed mercury for ſeveral months to a fire of 180 degrees: It became black, and in all reſpects yielded a ſimilar black powder: Whence he he learned that fire and ſhaking have the ſame effect on mercury in this degree.

4. Mercury is changed by ſimple diſtillation.

Proceſs. In a ſand-heat he diſtill'd from a glaſs retort 18 ounces of mercury *Amſterdam* weight, bought of the company there, into a receiver fill'd with pure water to the height of 4 inches, till no more running mercury remain'd in the belly of the retort. He dried and depurated the mercury with filtring paper, that it might be quite dry and cleanſed from all impurity, and likewiſe from the black powder brought over with the mercury in every diſtillation; and this he repeated for 52 times: In every diſtillation there aroſe a red, ſhining, powder in the retort.

Effect. After 52 diſtillations there were four drachms and a half of an acrid, red, ſhining, powder, which purges both upwards and downwards; and 16 ounces and five drachms of mercury; therefore, ſix drachms and a half were loſt; a thing not to be avoided, as ſomething always evaporates thro' the luting, and as ſome of the black powder, and a little mercury ſticks to the filtring paper every time of drying; ſo that upon repeating the operation, the quantity may at laſt be conſiderable: The powder obtain'd was ponderous, of a ſhining red colour, exceeding friable, of a very acrid, metallic, nauſeous taſte, greatly diſordering the human body for a conſiderable time, and diſpoſing to excretions. Mercury treated in this manner appear'd more fluid than the common ſort.

Cor. 1. Mercury thus urged by fire, from a fluid becomes a powder almoſt $\frac{1}{28}$ part of its weight. 2. From the brightneſs of a ſilver'd mirror, it is turn'd to a ſhining, ruddy, colour. 3. From very inſipid to a very acrid, diſagreeable, metallic, penetrating taſte. 4. From very mild to a virulent, poiſonous, acrid, ſubſtance, diſordering the body, and cauſing pain. 5. From volatile to a more fixt ſubſtance, not ſublimable with the ſame degree of fire as before. 6. The remaining part changes more fluid; in other reſpects alike. 7. Mechanical motion, and a ſmall degree of fire, communicate a black colour to mercury in a cloſe veſſel; and a greater degree of fire, a red colour.

5. He was deſirous to know what farther changes mercury might undergo, if urged with the degree of fire requir'd for diſtillation.

Process. He caus'd distil 15 ounces and five drachms of the mercury remaining after process 4, and that in the same manner as before, till nothing remain'd in the bottom of the vessel. What came over, after depurating and drying it, he pour'd again into the same retort, repeating the operation 448 several times. And now this mercury was perfectly distilled 500 times: It always yielded something red; and it came over every time still more fluid and pure. At last he made the fire more intense; but then that ruddy powder seem'd rather to decrease than increase; the mercury being, probably, in part revived.

Effect. The powder at the bottom of the retort weigh'd one ounce, five drachms, and 21 grains. The remaining quicksilver after 500 distillations weigh'd nine ounces and five drachms. But in so many distillations the retorts would sometimes crack; and so some mercury escape, besides what was lost in purifying and drying it so many times.

Cor. 1. The corollaries of process 2, 4, hold true in this process, 2. Mercury, as to one part thereof, is immutable. 3. But as to the other it is continually changing. 4. From its changed form it returns perhaps to its pristine species. 5. And reviving by the new action of fire, it again returns to its changed species.

6. That property of mercury, whereby the fire changes it into a powder, is scarcely destroyed by distillation.

Process. He distill'd in a glass retort, till the whole came over into the receiver, pure fluid mercury, from which he had obtain'd two ounces, one drachm, and 51 grains, by 501 distillations (according to process 2, 4, 5.) which remain'd of 10 ounces five drachms and a half. The bottom of the retort was as clean, as if newly blown; only there was a shining, ruddy, beautiful, small, ring round the inner surface of the retort, at which the mercury stood before distillation. After depurating and drying the mercury, he pour'd it again into the same retort, and re-distill'd it, repeating the operation ten times: At each time there was more of that red powder, and in no less quantity than from crude mercury.

Effect. The mercury was very vivid and shining; the fixed powder, to the quantity of seven grains, was beautifully ruddy, in other respects as by process 2, 4, 5.

Cor. The mutability of mercury into this powder, by the action of fire, still remains, after $\frac{1}{5}$ part is reduced. 2. It likewise

likewiſe continues after 511 diſtillations, each of which contributes ſomewhat to the producing that powder; tho' there be no addition of new mercury. 3. That powder, therefore, is ſcarcely to be reckoned as an impurity ſeparable from the *nucleus* of mercury by diſtillation. 4. And hence it appears, that by this means it undergoes a change; but that it is by this means defecated is not ſo certain. 5. Fire is not thus united to mercury, as ſome modern chemiſts affirm. 6. The limits beyond which this powder is no longer producible can ſcarcely be aſſigned. 7. If that powder ariſe by the action of fire from the crude ſulphur of mercury, diſtillation does not diſcharge the mercury of it.

7. To examine the powder got by the 2, 4, 5, 6. proceſſes.

Proceſs. He put two ounces, one drachm, and 51 grains of the powder into a clean, glaſs-retort, coated with a mixture of loam and ſand; he gradually heated the retort with a naked fire for three hours in a ſand-furnace, till it was almoſt ignited.

Effect. From the powder there came over one ounce and half a drachm of pure, revived, mercury. In the bottom of the retort there remain'd ſeven drachms and a half of a bright ruddy powder; there ſtuck a little in the neck of the retort, and in the glaſs-veſſel luted to its neck; and probably, ſomething was diſſipated by ſo intenſe and conſtant a fire.

Cor. Mercury is recover'd from the powder into which it was reduced by fire. 2. When revived, it recovers all its priſtine qualities, and loſes all its acquir'd ones. The ſame quantity of mercury is got from the powder. 3. Its acquir'd fixity cannot bear a great degree of fire. 4. Yet in this powder one part is more fixed than the other; this latter ſtill continues a powder, and the former becomes mercury.

8. To examine further the powder remaining after the preceeding proceſs.

Proceſs. In a clean glaſs-retort, coated with a mixture of loam and ſand, he committed 7 drachms and 37 grains of the powder to a naked fire, gradually heightened, till at length the retort became quite glowing hot in a fire of ſuppreſſion; and he kept it thus ignited for four hours.

Effect. There came over into the receiver ſeven drachms of pure revived mercury; at the bottom of the retort were 15 grains of a duskiſh ſubtile powder, fixed in ſo great and laſting a degree of fire; the bottom had alſo a broad, fine,

fine, ſtain, of an exceeding beautiful red colour, and penetrating into its ſubſtance.

Cor. 1. Mercury by the action of fire alone is changed into the powder already deſcribed proceſs 2, 4, 5, 6, 7, 8. 2. This powder by the ſole action of fire is changed, but by a greater degree thereof, into mercury. 3. Thus the ſerpent has bit itſelf, and dies. 4. But it is again reſuſcitated more glorious. 5. After ſo much labour, ſo intenſe and conſtant a degree of fire, out of 17 ounces of mercury there remained only 15 grains fixed in the retort, ignited to ſuch a degree, as to be ready to fuſe. 6. The ſilver, gold, and other metals, that by this means are ſought for in mercury, are hardly any at all in compariſon of the expence and labour. 7. Of the powder fixed in this manner from mercury, only $\frac{1}{72}$ part remains fixed in this degree of fire, and the other parts are converted into mercury. 8. There were 22 grains loſt, or whether they were not diſſipated? Or whether that weight, added to mercury by fire, be not again ſeparated from it by a greater degree thereof. 9. Mercury being of an uniform, ſimple nature, cannot be ſeparated by diſtillation into diſſimilar parts; nor into fix'd, and volatile; pure and impure; nor into different elements.

9. He put 13 grains of the laſt fix'd powder, proceſs 8. into a crucible, in an open fire before a blaſt-heat, till the crucible was entirely ignited; and he kept it at this pitch for $\frac{1}{4}$ of an hour. The powder remain'd fix'd at the bottom of the crucible, but ſwell'd like a ſponge, and of a duſkiſh colour: Hence he learned that the powder had acquired a conſiderable fixity by the action of fire only.

10. Then he added a little *borax* to the fixed powder of proceſs 9. urging it with a blaſt heat in a crucible. It became one entire, friable, vitreſcent maſs, and fixed in ſo great a degree of fire.

11. Of the 15 grains of powder, that remain'd ſo fixed at the bottom of the retort of proceſs 8, the Dr. gave 2 grains to a ſworn and ſkillful aſſayer at *Amſterdam*, to be teſted with the utmoſt accuracy with lead, according to the rules of art: But it was all entirely diſſipated; there is, therefore, neither gold nor ſilver in this powder.

12. He gave a ſworn and ſkillful aſſayer at *Amſterdam* 13 grains of proceſs 10. fus'd with *borax* into a vitreſcent maſs, to be teſted with lead: Of the whole maſs there remained nothing fixed: Conſequently, there is neither gold nor ſilver therein.

Cor.

Cor. 1. Mercury continues in the fire to retain its nature unalterably. 2. It is ſimple, nor ſeparable by diſtillation into different parts. 3. It is fixed by fire, and ſeems changed in its external form. 4. Under this appearance, it acquires in various parts various degrees of fixity. 5. Yet none of theſe parts had acquired, from ſo intenſe and conſtant a fire, the fixity of gold or ſilver. 6. The fixing cauſe, fire, penetrating glaſs, changes a part of mercury in this manner, either by its ſimple action, or by uniting therewith. 7. Fire thus acting after 511 diſtillations, could neither by its action nor union convert the leaſt particle of mercury into gold or ſilver. 8. But a greater degree of fire yields true mercury from that which was fix'd in this manner by fire; or it is diſſipated by lead on the cupel. 9. It does not, therefore, appear, by theſe experiments, that any known metal is produced from mercury and fire, thus conſpiring: The 13 grains above did not flux in a blaſt heat; did not ſtand the teſt of lead, nor amalgamate with mercury. 10. Fire, therefore, by theſe experiments, is not ſhewn to be the *ſulphur philoſophorum* that fixes mercury into metals. 11. But it ſeems probable, that the *ſulphur ſophorum proximum* is ſomething different. 12. The fixed part is not the impurity of mercury, nor its crude fetid ſulphur: For, it is again converted into mercury. 13. The depuration of mercury from all earthy impurity and crude moiſture ſeems hardly performable ſo eaſily by diſtillation alone: But probably by ſome other more ſecret way. 14. By means of fire neither gold nor ſilver are obtainable from mercury. The ignorant, and fanciful, are credulous and big with hopes. Mercury ſtill remained mercury. 15. We are on our guard againſt the cheats of impoſtors, who promiſe ſuch effects from mercury and fire in a ſhort time, or even a few months; when indeed there is not the leaſt ſign of it in ſeveral years.

13. Mercury detain'd under boiling water, does not riſe from the bottom of the veſſel.

Proceſs. He pour'd a drachm of pure mercury, twice diſtill'd, into a glaſs urinal, which he fill'd up with rain-water; then he ſet it on an open fire, and the water boil'd for 8 hours: Yet ſo as that always ſome water covered the mercury. Then weighing the mercury he had juſt a drachm without any waſte. Again he pour'd a drachm of mercury into a clean, dry, glaſs veſſel, which he fitted within a copper, ſo as to ſtand ſteady; he fill'd the copper with water, and made it boil 8 hours: The veſſel was cylindrical, open, 2 inches and ½ deep, and ſet in ſuch

uch manner as no water could enter into it. After the operation, the mercury weigh'd a drachm without any waste. He poured water into a glass body with pure mercury, under an alembic; he boiled the water for a considerable time, and no mercury came over: He continu'd boiling, till all the water being evaporated, the mercury became dry at the bottom of the vessel; and yet without increasing the fire, the mercury immediately ascended to the sides of the body, and into the still-head: The reason of this appears from what the Dr. has said in his *Institutiones chemicæ* on the articles fire and water.

14. Mercury may be changed by art, so as to ascend from the bottom of a vessel by the heat of vinegar which is not brought to boil.

Process. He shook an *amalgama* of $\frac{1}{2}$ a pound of lead, and $1\frac{1}{2}$ of mercury in a glass vessel; whence was produced a very black powder, which he put into a glass body, 14 inches high, pouring thereon twice distilled wine-vinegar; he evaporated the phlegm by a gentle distillation; then he heighten'd the fire a little, but without making the liquor boil: The mercury came over along with the phlegm into the still-head, and from thence into the receiver. He experienced the same thing by other methods; and this phenomenon deserves to be farther consider'd by chemists. By a method pretty near a-kin to this the Dr. observed that mercury became so volatile, as in his digesting furnace to be rais'd up the sides of the vessel by a less degree of heat than that of a healthy person; and then it was far from being pure, being mix'd with metal, and very dry.

15. *Geber* writes that pure mercury is heavier than gold. Dr. *Boerhaave* long ago endeavour'd to discover whether mercury could be rendred denser, and consequently heavier than it naturally is: He began by attempting to separate the more light and variable, from the remaining more ponderous part, but he could not effect it. He afterwards endeavour'd to purify it several ways; but all in vain: Yet he discover'd some things that are worth taking notice of, and which are, as follows. Upon examining hydrostatically a mass of 2 ounces of the purest gold in rain water, purified by a gentle distillation; its weight to that of water, was as $19\frac{119}{500}$ to 1; common mercury of the shops distill'd once in a retort, was to the same water, as $13\frac{57}{100}$ to 1; mercury amalgamated with the purest gold, and distill'd some hundred times therefrom, was to water, as

13

$13\frac{55}{100}$ to 1; mercury treated in this manner with the pureſt ſilver was to water, as $13\frac{58}{100}$ to 1; mercury amalgamated with lead, reduced into a powder, and recovered thence by an intenſe fire, was to water as $13\frac{55}{100}$ to 1; mercury diſtill'd 511 times, was to water as $14\frac{11}{100}$ to 1: Theſe ſtatical experiments were very carefully made and with exact inſtruments.

Cor. 1. If purified mercury become lighter; it is then highly purified by gold and lead. By *Suchtenius*'s and *Philalethes*'s art it remains the ſame. 2. If purified mercury become heavier; it is then highly purified by means of ſilver, with reſpect to other metals, but moſt of all by ſimple diſtillation, by converting it into the red precipitate *per ſe*, and by the reſuſcitation of it from thence. 3. Mercury may become denſer by means of ſilver and fire. 4. It may become denſer by diſtilling it much by fire. *Quær.* whether this be the beſt way for depurating and perfecting it? 5. Whether mercury depoſites its heavieſt part in gold? 6. And whether what it thus depoſites be the ſeed of gold? 7. Whether fire, by coction, fixing and reſuſcitating of mercury 511 times, add to that heavieſt part? And how far that may be effected? Whether mercury, by continuing the operation, may at length be condens'd into the weight of gold? And whether then it would be the *aurum vivum*, or *mercurius philoſophorum*? All which Dr. *Boerhaave* leaves to competent judges to examine.

A Spirit level to be fixed to a Quadrant for taking a Meridional Altitude at Sea, *when the* Horizon *is not viſible; by Mr.* John Hadley. Phil. Tranſ. N° 430. p. 167.

THE neceſſity of ſeeing the horizon, in order to find the latitude of a ſhip at ſea, has always been ſo great an inconvenience, that any method for determining it without a horizon, muſt be of conſiderable uſe, tho' it ſhould be liable to an error of a few minutes.

This level (Fig. 7. Plate XI.) conſiſts of a glaſs tube A B, bent into an arch of a circle, and containing ſuch number of degrees, as will be moſt ſuitable to the degree of exactneſs with which the obſervation can be made: Its bore muſt not exceed one

one tenth of an inch in diameter, that the liquor in it may the better keep together, and its 2 ends ſtand perpendicular to the tube in all poſitions: Nor ſhould it be much leſs, leſt the hanging of the ſpirit to the ſides ſhould hinder it from ſettling ſo truly by its weight to the loweſt part of the tube. This tube is cemented into another braſs one C D E F of the ſame curvature; the outer half of which is taken off, ſo as to ſhew the glaſs, leaving only a ſmall part in the middle D F entire, in which a ſmall ſtop-cock G is placed. The glaſs-tube is divided in 2 in the middle to make room for this ſtop-cock, the key of which muſt have a hole of only about one hundredth part of an inch, for the paſſage of the liquor. The outer ends of the glaſs tube muſt have a communication with each other round about by means of 2 ſmall pipes I and K, and the tube H; the manner of which is ſufficiently ſhewn by the figure. Each half of the glaſs tube A B muſt have a ſcale of degrees anſwering to the curvature of the tube, ſubdivided at pleaſure: They may be numbered either on the upper or under ſcale in the figure; and obſerve that in the under ſcale 2 degrees are number'd as one; the reaſon of which is, that the motion of the ſpirit in the tube increaſing the number on one hand, and at the ſame time as much diminiſhing that on the other, their difference is alter'd thereby; ſo as to anſwer to double that motion. The diviſions of the ſcales are cut on the edge of the braſs half tube, or trough, which is made thick for the greater ſtrength. In one of the ſmall pipes I or K, juſt againſt the return of it, which enters the end of the firſt mentioned glaſs tube at A or B, is a ſmall hole, by which to introduce into it ſo much ſpirit of wine, as may fill it from the middle of the ſcale on one hand to the middle of that on the other: This hole may be afterwards ſtopped by a ſcrew-pin. The inner ends of the 2 halves of the glaſs-tube A B ſhould be fixed into the entire part of the braſs-tube D F with a cement made with old hard bees wax, or ſome other materials not diſſolvable by ſpirit of wine; as ſhould likewiſe the ends of the ſmall pipes I and K into this and the tube H: Thoſe halves, *a a* to the remaining part of their lengths, may be faſtened down with any ſtrong cement.

This level may be ſet on to one of the limbs of the quadrant, fitted up for this purpoſe, in the manner expreſſed in the Fig. It hath an index moveable on the centre, and a ſpring at the other end to keep it ſteady, when it is directed to any of the diviſions on the arch, which needs no other diviſion than that into whole degrees. The index may be furniſhed either

with

with plain ſights, or may carry a ſhort teleſcope, with a vane in its *focus*, to receive the image of the ſun, when it is bright enough: But if the ſun be hazy, or the moon, or a ſtar, be obſerved, a ſliding ſhutter may be drawn out to tranſmit the rays of light to the eye glaſs. The vane has likewiſe a thread fixed on it, perpendicular to the plane of the quadrant. The whole inſtrument (for the eaſier managing it) may be ſupported by a ſtaff, reſting with one end on the floor.

The manner of uſing it is thus: Holding the quadrant in a vertical poſition, with the limb, to which the level is fixed, parallel to the horizon, raiſe the index to ſome diviſion of the arch, as near as you can to the true height of the object, which is ſuppos'd to be near the meridian; and conſequently to alter its altitude but ſlowly: Then turning the key of the ſtop cock, ſo as to let the ſpirit of wine paſs thro' the ſmall hole therein, keep the image of the object as cloſe to the thread on the vane as poſſible, endeavouring that the unavoidable vibrations of it above and below the thread, may be equal, both in reſpect of their length, and the ſwiftneſs of their motions, &c. Continue this till the ſpirit ſeems quite ſettled to ſome part of the ſcale, and ſomething longer. This it will do ſlowly, but without any ſenſible vibrations: For, the ſtop-cock allowing it no paſſage but thro' the ſmall hole in its key, will give ſuch a check to its motions, as not only to ſtop thoſe vibrations, but alſo to hinder its being thrown backwards and forwards in the tube by any ſhocks of the inſtrument; and yet as far as Mr. *Hadley* has obſerved will not prevent its ſettling (with ſufficient truth, tho' ſlowly) to the loweſt part of the tube. About half a minute of time or more may be neceſſary for this, according as the aforeſaid ſmall hole is greater or leſs in proportion to the bore of the tube. When you judge the ſpirit quite ſettled, turn the ſtop-cock again. It is of no importance that the image of the object be exactly on the thread at the inſtant that this is done. Obſerve againſt what degree, and part of a degree, each end of the ſpirit in the tube ſtands. If your ſcale be number'd like the upper one in the Fig. and the quantity of ſpirit be exact, both ends will agree, and the degrees and parts marked muſt be added to, or ſubſtracted from the altitude, ſhewn by the index, according to the directions. If the ends do not exactly agree, take the mean between them: If you uſe the under ſcale, ſubſtract the leſſer number from the greater, and add or ſubſtract the exceſs, the number reſulting will ſhew the mean elevation of the index, during the latter part of the obſervation, and will differ from the true altitude of the object about half so much, as the vibrations of its image above and below the aforemention'd thread on the vane fail of compensating one another during that time. If either end of the spirit leave the scale, the index must be remov'd 3 or 4 degrees, and the observation repeated. Instead of the curve tubes A and B, 2 streight ones might be used, set together in such manner as to form a very obtuse angle in the middle; but then it will be convenient to have the quantity of spirit more exactly fitted to the scale, because the allowing for the difference will be something more troublesome. If the observer have an assistant to attend to the level, while he himself observes the object, the whole *apparatus* of the brass tube, and stop cock, may be omitted, substituting in its room a plug only with a small hole in it, which may be wrapped round with a very thin slice of cork, and so thrust down into the middle of the glass-tube. The cutting the glass tube in half in the middle may likewise be avoided; if instead of the stop-cock at G, there be one fixed in one or both the pipes I and K, to open and stop the passage of the air, with a larger hole in their keys, and likewise a plug with a small hole, thrust down into the middle of the tube, as before. The bore of the small pipes I and K, and the tube H, must not be so narrow as to make it difficult to reduce the spirit into its place, if by any accident either end of it should get into them. Mr. *Hadley* was informed, that an object may be easily kept in view, even in pretty rough weather, thro' a telescope, that magnifies about 10 times. Now as such telescopes seldom comprehend an area of much more than one degree in diameter, or at most 1 deg. 20 min. it follows that the axis of the telescope is always kept within 40 min. at most of the object, and that is the greatest vibration of the image above and below the thread on the vane. If this be allow'd, it seems reasonable to expect that the medium of the vibrations one way should not exceed the medium of those the other way, more than by about $\frac{1}{5}$ or $\frac{1}{6}$ part of the greatest vibration; *i. e.* about 7 or 8 min. the half of which will be the error of the observation. In still weather it will probably be much less, if the instrument be in the hands of a person moderately skill'd in observing.

The

The Dissection of a Female Beaver, *and an Account of* Castor *found in Her; by Dr.* Mortimer. Phil. Transf. N° 430. p. 172.

IN the *Acta Erud.* for *August* 1684, p. 360 and *seq.* Dr. *Mortimer* finds an account of the dissection of a male and female beaver by *E. G. H.* who mistakes in opening the male, the receptacles of the *castor* for the *uterus*, and the 2 glands below them for dugs; and as he found a *penis* and *testes* in the same animal, he was apt to conclude it an hermaphrodite: But on dissecting the female, he found an *uterus*, with 2 horns like that of bitches, besides the receptacles of the *castor*, which the Dr. should have thought sufficient to set the *Author* to rights, as to the former beaver being an hermaphrodite.

Johannes Francus, a *German* physician, hath publish'd a treatise entituled *Castorologia explicans castoris animalis naturam & usum medico-chemicum, August. Vindel.* 1685. *octavo*, being a commentary on a treatise formerly wrote by one *Johan. Marius*, a physician at *Ulm*; who in *sect.* 7. describes the receptacles of the *castor*, as bags near as big as a goose-egg; and that they have been wrongly called the *testes*, being in females as well as males; only that they have no communication with the *pudenda*. His commentator *Francus* recites the opinions of some modern writers, who are still in the old error as ancient as *Ælian*, who says, that the beaver eats out his own testicles, when pursu'd by the hunters, as if he were conscious those were the parts his persecutors want, and seek his life for. He cites *Adam Zwikerus*, as having this notion; as also *Joh. Harderus* and *Joh. Schapplerus*: Nay, some have thought so absurdly, as to imagine that the beaver had 4 testicles. And he says, that *Gulielmus Rondeletius* was the first who dissected a beaver with accuracy sufficient to refute the old error, shewing that the *castor* was not the testicles, but peculiar bags lying in the groin. *Marius sect.* 9. says, that beavers are found in the *Ilera* and the *Danube*, particularly in a small river near *Leipheim*, call'd the *Biber*, from the vast numbers of beavers formerly found thereabouts; but that now they are all destroy'd, and none to be found in the *Danube*, except in *Austria*; that there are a few in some rivers in *Swisserland*, in *Poland*, in *Muscovy*, in the *Wolga*, in the *West-Indies*, especially in *Canada*. The greatest quantity of *castor*, which is brought to *England*, comes from *Maryland*, *New England*, and *Hudson's Bay*. *Marius* in *sect.* 9. speaks of a peculiar virtue in the fur of the beaver; that

that by wearing a cap made of it, and anointing the head once a month with oil of *castor*, and taking 2 or 3 ounces of *castor* in a year, the memory thereby is greatly strengthen'd: And tho' this seems to be only a superstitious fancy, yet the Dr. mentions it, as such a notion might have probably at first brought the use of its flock into request for making of hats.

In the *Memoirs* of the *Royal Academy of Sciences* at *Paris* for 1704, *p.* 48 and *seq.* is an extract of a letter from M. *Sarrasin*, king's physician in *Canada*, concerning the dissection of a beaver. He says the largest are 3 or 4 foot long, and about 1 foot or 15 inches broad in the chest, and haunches; that they commonly weigh about 50 pounds; that they usually live to the age of 20 years: But *Francus* on *sect.* 8. says, they live 30 or 40 years; and that he heard of a tame one being kept 78 years: The *European* probably may be generally longer liv'd than the *American* beavers. Dr. *Sarrasin* farther says, that a great way north, these animals are very black, tho' there are some white: Those in *Canada* are commonly brown; but their colour grows lighter, as they are found in more temperate countries: For, they are yellow, and almost even of a straw-colour in the country of the *Ilinois* and *Chaovanois*.

The stomach, according to Dr. *Sarrasin*, is upwards of a foot in length, and about 4 inches broad in the part next the spleen; at about $\frac{2}{3}$ of its length, it is contracted to half its former capacity for an inch in length; and then it widens again to 3 inches towards the *pylorus*, which is rais'd very high, is round, and drawn towards the spleen by a membrane, which adheres to the *oesophagus* by its other end: Tho' this dilatation seem to make a second stomach, it only serves to retain the aliments especially the more solid a longer time; as the wood, which only undergoes a slight extraction, passing thro' with little or no alteration; whereas herbs, fruits and roots are perfectly dissolv'd. The membranes of the stomach are very thin; so that this second part will scarce bear being distended with wind. In a beaver full grown, the *cæcum*, which is in form of a sickle, is 18 inches long on the hollow side, and 30 on the round side, and 4 inches broad at the larger end, and will contain between 5 and 6 pints of water. When he describes the receptacles of the *castor*, he says, that the uppermost bags contain a soft resinous matter, but the lower an oily matter. The greatest bags weigh only 2 ounces. He could never discover of what use this *castor* was to the beavers themselves, being well assured that they do not swallow it to excite their appetite. It

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is likewise false, that the hunters use it as a bait for the beavers, tho' they do so for those animals, which infest the beavers, as martins, foxes, bears, *&c.*

As to their manner of living, they choose a low level ground, water'd with a small rivulet; that it may be easily overflow'd by making damms a-cross it; these damms are made by thrusting down stakes of 5 or 6 foot long, and as thick as one's arm, pretty deep into the ground; and these they wattle a-cross with tender pliable boughs, and fill up the spaces with clay, making a slope on the side against which the water presses, and leaving the other perpendicular. Their houses are made after the same manner; the walls upright, 2 foot thick, and at top in form of a dome; they are usually oval, 5 or 6 foot long on the inside and near as broad, being sufficient to lodge 8 or 10 beavers; and 2 or 3 stories high, to which they retire as the water rises or falls. They sometimes build several houses, which communicate with one another: There are he says some beavers call'd terriers, which burrow in the earth: They begin their hole at such a depth under water as they know it will not freeze at; this they carry on for 5 or 6 feet, and but just large enough for them to creep thro'; then they make a bathing-place of 3 or 4 foot every way; from whence they continue the burrow, always ascending by stories, that they may lodge dry as the water rise: Some of these burrows have been found to be 100 foot long. They cover the places where they lie with weeds; and in winter they make chips of wood, which serve them for matelas's. In summer they live on herbs, fruits and roots, but they lay up a provision of wood against winter; a stack of 25 or 30 foot square, and 8 or 10 foot high, is the usual quantity for 8 or 10 beavers: They eat those pieces only which are soaked in the water. The above-cited *Marius* says, they only live on such vegetable food: But his Commentator *Francus* says on *sect.* 4. that they prey upon fish, cray-fish, and likewise frogs, as others do; and that they make burrows in the banks of the rivers, which open under the water.

In the *Memoires pour servir à l'histoire naturelle des animaux*, composed by order of *Louis* XIV. and printed at *Paris* in 1671. There is p. 64. and *seq.* an anatomical description of a beaver. In p. 69, the *Author* says, that the real testicles resemble those of a dog; that they lie close to the *os pubis*, on the outer part of the sides; and that they are not at all discernible thro' the skin. The *penis* had a sharp pointed bone, like that of a dog; but instead of lying with its point towards the

the navel, it lay towards the tail, and so deep buried in the fissure, which serves in common for the *anus*, the *penis*, and excretory ducts of the castor, that the sex could not be distinguished, till the skin was taken off: In the intestines were found eight large worms resembling common earth-worms; three of which were seven or eight inches long, the rest only four: In the heart were evident traces of the *foramen ovale*: A little below the coronary vein the author mentions a valve, which he says is call'd *valvula mobilis*, and closes the whole *cava*, but opens so that the blood may readily flow from the liver towards the heart, and not from the heart back again towards the liver. He says that the brain was but one inch $\frac{2}{3}$ long, and one and a half broad, which was very small in proportion to the size of the animal: and still more so in proportion to the sagacity, with which it is said to be endow'd. These are the most remarkable particulars Dr. *Mortimer* met with in perusing the above-mentioned books: He now only adds such as they have omitted, or such as especially regard the sex of this female beaver.

This animal was kept for about three months in Sir *Hans Sloane*'s garden; was but about half grown, not exceeding 22 inches in length from the nose to the root of the tail, the tail was eight inches long: She was very thick, and paunch-bellied: the shape of the head, and indeed of the whole animal, except the tail and hind feet, very much resembled a great over-grown water-rat. Her food was bread and water: Some willow-boughs were given her, of which she eat but little; but when she was set loose in the garden, she seemed to like the vines much, having gnaw'd several of them as high as she could reach, quite down to the roots: She likewise gnaw'd the jessamin; but least of all some holly trees. The Dr. was told that in *Carolina* they particularly love the sassafras, and will cut down trees of about two or three foot diameter. She was put into a fountain with some live flounders, but she never offer'd to strike at them, as an otter would have done: When she eat, she always sat on her hinder legs, and held the bread in her paws like a squirrel; When she slept she commonly lay upon her belly, with her tail under her. In swimming she held her fore-feet close up under her throat, with the claws closed, as when one brings the ends of the thumb and all the fingers close together, never moving her fore-feet till she came to the side, and endeavoured to come out. She swam with her hinder feet only,

only, which had five toes, and were webbed like thoſe of a gooſe; the tail which was ſcaly, and in form of the blade of an oar, ſerv'd as a rudder, with which ſhe ſteer'd, eſpecially when ſhe ſwam under water, which ſhe would do for two or three minutes, and then come up to breathe ſometimes, raiſing her noſtrils only above water: She ſwam much ſwifter than any water-fowl, moving under water as ſwift as a carp: The hinder being much longer than the fore legs, made her walk but ſlowly, or rather waddle like a duck when on dry land; and if drove faſt along, ſhe could not run, but go by leaps or jumps, flapping her tail againſt the ground. Her excrements were always black and exceeding fetid; her urine turbid and whitiſh, and very ſtrong ſcented. He never heard her make any noiſe, only a little ſort of a grunting, when driven faſt and provoked. She ſeemed very briſk, and thrived well with the above-mentioned food, being turned into the fountain to bathe three or four times a week; whereas the author of the *Memoires de l'Hiſtoire des Animaux*, above cited, ſays, that the male beaver, they had diſſected, had liv'd ſeveral years at *Verſailles*, without being permitted to go into the water. The beaver here ſpoken of had one day convulſion fits, very like the epilepſy in men, from which ſhe recover'd ſoon, and was very well after them; till at laſt ſhe was killed by a dog, and then torn in ſuch manner, that nothing particular could be obſerv'd either in the heart or lungs; the liver and kidneys were quite torn to pieces; there were ſeveral holes bit thro' the ſtomach, out of one of which crawled a worm about ſix or ſeven inches long, like a common earth-worm, probably of the ſame ſort as thoſe mentioned before by the author of the *Memoires*. The bowels in general ſeemed very much to reſemble thoſe of a dog, except the *cœcum*, which was of that prodigious ſize as mentioned above. The *ovaria* and *uterus* were divided into two horns, in the ſame ſituation as in bitches: The bladder was contracted about the ſize of a walnut, and very much corrugated on the outſide; it lay exactly over the body of the *uterus*; the *meatus urinarius* ran upon the *vagina* above two inches in length: Juſt below the *os pubis* on each ſide of the *vagina*, and above the *meatus urinarius* (ſuppoſing the animal to lie on her back) was found a pair of bags in form of pears, about one inch and $\frac{3}{4}$ long, and one inch broad, diverging at their bottoms, or broad ends, but joined almoſt cloſe together at at their necks, or narrow ends, which were canals communicating with the adjoining glands: The membranes forming theſe bags were very tough, full of *rugæ* and furrows, and of a livid dirty colour; they were hollow, and capable of containing about an ounce of water. Upon opening one of them, there was found a ſmall quantity of a dark brown liquor like tar, of the conſiſtence of a thick ſyrup, which ſmelt exactly like caſtor, and had a ſort of pungency like ſpirit of hartſhorn, which the dried caſtor doth not retain. It is very probable that the youth of this beaver was the reaſon theſe bags were not full; and that the caſtor itſelf was not of that ſoft reſinous conſiſtence, as mentioned by Dr. *Serraſin loc. citat.* Theſe muſt be the bags miſtaken in the *Act. Erudit.* for the *uterus.* About an inch lower were ſituated a pair of glandular bodies, one on each ſide the *vagina*, about an inch and a half in length, and half an inch in breadth; of an oblong irregular ſhape, of a pale fleſh-colour, like the *pancreas*, or other glands, and having ſeveral protuberances externally: Theſe glands ſeem to communicate with the above deſcribed bags, the canals coming down from them being inſerted into the glands, and both the bag and gland on each ſide having but one orifice, which is black, beſet with long black hairs, and opening into the lower part of the *rima*, or great fiſſure, into which likewiſe the *vagina* and *anus* open. From the ſtructure of theſe glands, and their connection with the bags, the Dr. concludes, that the caſtor is ſecreted in the ſaid glands; where it is fluid like oil, light colour'd, and ſcarce having any ſmell; that it runs down into the bags, which ſerve as receptacles to collect a large quantity together for the uſe of the beaver; and that in theſe receptacles it loſes its thinner parts, becomes more inſpiſſate, of a higher colour, and ſtronger ſcent, much in the manner as the gall in the gall-bladder, which there becomes ſo different from what it was in the liver.

It is certain that ducks, geeſe, and all ſorts of water-fowl, have a gland in their rump, from which they expreſs with their bill an oily matter, with which they anoint or dreſs their feathers, to prevent their being ſoaked by the water, in which they ſwim; and the glands of that large ſort of duck, commonly call'd the *Muſcovy-duck*, or rather *Musk-duck*, afford an oil, as fragrant as civet: He, therefore, thinks it probable, that as the beaver is an animal, which frequents the water, as much as thoſe water-fowl, the caſtor is a ſub-

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in their nests, or pouring calls, which were much con[illegible] [illegible] with the adjoining glands. The membranes forming these bags were very rough, full of rugae and furrows, and of a dull dirty colour; they were lighter, and capable of containing about an ounce of water. Upon opening one of them, there was found a small quantity of a dark brown liquor like [illegible] of the consistence of a thick syrup, which smelt exactly like castor, and had a sort of pungency like spirit of hartshorn, which the dried castor doth not retain. It is very probable that the youth of this beaver was the reason these bags were not full; and that the castor itself was one of that [illegible] consistence, as mentioned by Dr. Sir [illegible] [illegible]. These must be the bags mistaken in the [illegible] for the testes. About an inch lower were found a pair of glandular bodies, one on each side the vagina, about an inch and a half in length, and half an inch in breadth, of an oblong irregular shape, of a pale flesh colour, like the pancreas, or other glands, and having several appearances externally. These glands seem to communicate with the above described bags, the canals coming down from these being inserted into the glands, and both the bags and gland of each side having but one orifice, which is black, beset with long black hairs, and opening into the lower part of the rectum, or great sinus, into which likewise the vagina and anus open. From the structure of these glands, and their connection with the bags, the Dr. concludes, that the castor is formed in the said glands, where it is fluid like oil, light coloured, and scarce having any smell; that it runs down into the bags, which serve as receptacles to collect a larger quantity together for the use of the beaver; and that in these receptacles it loses its thinner parts, becomes more inspissated, of a higher colour, and stronger scent, much in the manner as the gall in the gall-bladder, which there becomes so different from what it was in the liver.

It is certain that ducks, geese, and all sorts of water-fowl have a gland in their rump, from which they express with their bill an oily matter, with which they anoint or dress their feathers, to preserve them being soaked by the water in which they swim; and the glands of that large sort of duck, commonly called the Muscovy-duck, or rather Musk-duck, afford musk, as fragrant as civet. Is it, therefore, that it probable, that as the beaver is an animal, which frequents the water, as much as other water-fowl, the castor is a [illegible]

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ſtance provided by nature to greaſe and anoint his fur with, in order to prevent the water from ſoaking quite to his skin; and as the caſtor is impregnated with penetrating pungent particles, it may likewiſe contribute to keep off the cold and chill, which the water might otherwiſe ſtrike to his body by remaining a long time therein.

Fig. 1. Plate XII. repreſents the parts of generation, and receptacles of the caſtor in a female beaver: A the two *ureters*; B B the *ovaria*; C the *uterus* lying under the bladder; D the bladder contracted and empty of urine; E the urinary paſſage, upwards of two inches long; F F the receptacles containing the caſtor; G G the two glands, opening by one common orifice, with the receptacles at H H, the orifices of the caſtor ducts; I the *vagina* cut off; K the *anus*; L part of the tail.

A Natural Hiſtory of the Air and Earth for the Year 1732; by Dr. Cyrillus. Phil. Tranſ. N° 430. p. 180. *Tranſlated from the* Latin.

THERE fell a greater quantity of rain in *January* and *December*, meaſuring 131 in the former month, and in the latter 111; and in *October* it likewiſe meaſur'd 108: But in *March* and *May* there was but very little rain: So that comparing together the ſeaſons of the year, there was more rain in winter and autumn; whereas the ſummer and ſpring, eſpecially the latter, inclined more to fair. This indeed, is common in *Italy*, and more agreeable to the temperament of the air, and to the hot and dry ſeaſon of the year: So that it may ſeem ſurpriſing, that at *Paris* the greateſt quantity of rain ſhould fall in *July*, *Auguſt* and *September*; as was conſtantly obſerv'd by the celebrated M. *De la Hire*: And that probably, becauſe, ſuch is the ſituation of the country thereabouts (having the ocean to the north and weſt) and ſuch the nature of the air, that in ſummer ſuch weather is more frequent there, as is joined with plentiful ſhowers of rain: Whereas in the kingdom of *Naples*, which is waſh'd by the *Tyrrhene* ſea to the ſouth and weſt, and ſurrounded by the *Apenine* mountains to the north and eaſt, ſuch rainy ſeaſons are leſs frequent: For, more plentiful vapours being rais'd from the ſea by the ſcorching heat of a ſummer ſun; ſuch as riſe from the ocean, and are carried in great quantities towards the land, may at that time cauſe more plentiful and frequent rains in the northern, and level parts of *France*: But in

Naples vapours arising less plentifully from the *Tuscan* sea will in summer afford less matter for producing rain; especially since the *Appenines*, and the contrary winds at that time from the *Midland* parts may easily oppose their course towards the land: From this mutual struggle of the winds both from the sea and land are occasioned these hot seasons, call'd *tropee*, which are rather remarkable for thunder and lightning than any considerable quantity of rain.

The snow, which about the latter end of 1731 lay upon the mountains and even the higher grounds, did in *January, February* and *March*, 1732 almost continue thereon, new snow falling daily upon the old. Even *Vesuvius* itself has several times been observed to be cover'd with snow: But in the city and suburbs it never continued on the ground. On the 29, 30, and 31. days of the preceeding year, namely 1731, it freezed; the ice was of a moderate thickness on the first day, thicker on the second, and became thinner on the third by a thaw coming on in the afternoon, Mr. *Hauksbee*'s thermometer falling to 57°, and the air quite calm on the two first days, and a northwest wind blowing on the third day: But about the close of *November* and on the first days of *December* 1732, at first a thick ice in the city, which afterwards became thinner, as in the diary. On the 23d of *February* hail in the suburbs; and on *March* 4. likewise in the city: On the 4. and after the 20. of *April* in the mountains. But on *Sept.* 14. there fell very large hail at *Foggia* with a strong whirl-wind which did no small damage both to man and beast in the open fields.

The winds were of different degrees of strength, and often contrary to each other, for the most part westerly in winter; at one time inclining to the south, and at another time to the north; which is a very common thing at *Naples*, as they have the sea to the west, but northerly winds were less frequent; yet on the 1. and 2. of *January* a very strong north east wind first clear'd the air, and afterwards remitting a little and turning to the north-west, it sprinkled the mountains with snow.

Here Dr. *Cyrillus* animadverts on that little machine for measuring the strength of the winds, described in *Phil. Trans.* N° 24. as both uncertain and false: For, with the least breath of wind the vane or flat side, may be easily raised from the perpendicular to 10 or more degrees: But the more it recedes from the perpendicular, the greater difficuly it has in rising; so that if in the first raising of the vane two degrees of strength in the wind be sufficient to make it run over 10 degrees of the

quadrant,

quadrant, 4 degrees will hardly be ſufficient to make it run over other 10 degrees; and conſequently, in order to raiſe the vane, for inſtance, to the 30th degree of the quadrant, the ſtrength of the wind increas'd to the ſixth and eight degree will not be ſufficient: Whence it appears, that we cannot exactly meaſure the ſtrength of the winds by this machine: For the increaſe of the ſtrength will not anſwer proportionably to the degrees, marked on the quadrant. To meaſure, therefore, the degree of ſtrength of the winds, it will be better to make uſe of that method, which Dr. *Jurin* propoſes in *Phil. Tranſ.* N° 379; and which Dr. *Cyrillus* made uſe of in his obſervations; namely to have recourſe to the motion of the trees, by carefully viewing of which, the ſtrength or degrees of the wind may be determin'd by any of the 4 numbers 1, 2, 3, 4, to be ſet down in the form of a meteorological diary; in ſuch manner as to call that the gentleſt motion of the air, and conſequently, the leaſt ſtrength of wind, by which the leaves of trees may be ſcarce ſhaken, and which Dr. *Jurin* would have marked by N° 1: Therefore, the greateſt force of the wind, that is, its 4th degree of ſtrength; is to be denoted by N° 4, when its *impetus* rages moſt againſt the ſame trees, ſo as perhaps to pluck them up by the roots; and conſequently, he would have the intermediate degrees of ſtrength denoted by N° 2 and 3: In fine, a perfect calm, that is, no ſenſible agitation of the air and trees to be denoted by 0.

The mercury in Dr. *Cyrillus*'s barometer did once on the 20. of *May* deſcend to 28. 82 *London* inches; which was the greateſt deſcent for that year: On that day there was a very ſtrong ſouth wind; and tho' the ſpirit in the thermometer was far from its greateſt degree of rarefaction; yet the ſuffocating heat proved uneaſy: On the contrary, the greateſt height of the mercury in the barometer, namely, 29.38 was obſerved on the 10. of *December*, an eaſterly wind blowing with 2 degrees of ſtrength, the air dry and cold, and *Veſuvius* emitting ſmoke with an *impetus*. Beſides, the height of the mercury was conſtantly obſerved greater all that month, than for the reſt of the months of the year: But on the 20, 21, 23, of *November*, as alſo on the 16, of *December* it roſe to 29.30 inches. It is to be noted, that the mean height of Dr. *Cyrillus*'s barometer is 29.4.

It is not to be omitted, that tho' the aſcent of the mercury in his barometer uſually accompany fair weather and northerly winds, as on the contrary, its deſcent, approaching rain and

ſoutherly

ſoutherly winds; yet the quite contrary has ſeveral times been obſerved; ſuch as its falling in fair weather, and riſing, when the air has been full of vapours: So that from thence one may probably gather, that the different weight of the external air doth not ſo much contribute to the different motion of the mercury in the barometer, as ſome alterations and changes in the mercury itſelf.

One of Mr. *Hauksbee's* thermometers exhibited the following phenomena. The greateſt heat this year, *viz.* 1732, was obſerv'd from the 9. of *July* to the firſt days of *Auguſt*: On the 23, and 24. of *July*, as alſo on the 17. the heat was at the height; that is, the cold of 4 deg. being overcome by the liquor aſcending to N° 4. This aſcent was likewiſe wont to happen the foregoing years: But what was peculiar to the year 1732 and uncommon was, that the greateſt heat ſhould laſt for 22 days, and almoſt always at the ſame pitch both day and night; the ſpirit in the thermometer being about N° 5, 6, 7 and 8, except on the 16. of *July* when a ſouth and north northweſt winds blowing alternately, with thunder, it rained at times 1 inch high nearly; at which time the ſpirit in the thermometer deſcended on a ſudden from 8 to 20 degrees.

The greateſt cold was obſerved at the cloſe of the preceeding, and at the beginning of the following year 1732, the ſpirit in the thermometer deſcending to 56 and 57 deg. at which time either ſnow was obſerved in the mountains, or froſt in the city. Likewiſe in *December*, when there was ice, the ſpirit in the thermometer was fallen to 55 and 56 deg. And here it is to be noted, that in the ſcale to *Hauksbee's* thermometer, the point of *froſt* is denoted by 65 degr. Yet Dr. *Cyrillus* has found by ſeveral years obſervations, that there was ice produced, when the ſpirits of the ſame thermometer, which were ſent him from *England*, only deſcended to 55 degr. vide *Phil. Tranſ.* N° 424. Whence it cannot at all be denied, that to produce ice there is required a leſs degree of cold at *Naples* than at *London*.

As to *Veſuvius*, it was quiet for almoſt the whole year: But at the cloſe thereof after the 9. of *December*, it began with an *impetus* to emit ſmoke in the day time, and ſometimes flame in the night. But on the 20. both the ſmoke and flame increaſed very much: Hence on the following days an internal noiſe and a report like the exploſion of cannon was heard ſeveral miles off, that both the wooden caſements of the windows and the glaſs trembled: Ignited ſtones were likewiſe hurled on high

high from the vent of the mountain; and these afterwards falling down again and resting on the declivity thereof, exhibited no inelegant, tho' dreadful sight, both to *Naples*, and places more remote: The ashes were scatter'd now at a greater, and now at a less distance, according to the direction and strength of the winds. From the 27 and 28 of *December* a very thick smoke that did not rise high, sprinkled the neighbouring places with coarse ashes. After the 29. the smoke and noise gradually abated: At length after the 4. of the following *January* all entirely vanish'd.

There was also an account, that mount *Ætna* at the same time belched forth smoke aud much fire with a noise; and that *Stromboli* made an uncommon noise, and burnt with a terrible flame: So that the repeated bellowing, and the alternate eruption of flame, appear'd to those that dwelt in the western coast of *Calabria* like the explosion of guns in a sea engagment.

As this year produced corn, except maiz, in a moderate quantity; so it yielded fruits of all sorts, and wine in greater abundance and sweeter than the preceeding year.

Of the Camphire *of* Thyme; *by Dr.* Neuman. Phil. Transf. N° 431. p. 202. *Translated from the* Latin.

IN *Phil. Transf.* N° 389. Dr. *Neuman* had communicated to the *Royal Society* an observation, that to him appear'd singular, and which happened unexpectedly in the distillation and separation of the essential oil of thyme; namely, a solid, dry, crystalline, white and pellucid body was observ'd in this oil, distill'd without any addition: And among other things he advanced, that he could take this substance by its outward appearance and composition for no other than a species of camphire: Because, in his opinion, it could not be rank'd among any other mixts (in so far as chemists have hitherto marked and distinguish'd both natural and artificial matters, and according to their primary qualities denominated them) but on the contrary be most properly and agreeably to reason referred to that mixt, call'd camphire: To this observation the Dr. added such circumstances and reflections as he thought necessary; and as to the rest, he left it to the farther enquiry and judgment of every one, to inform both himself and the curious farther about this matter.

Mr. *John Brown*, chemist, in *Phil. Transf.* N° 390. entirely differs from the Dr. both as to his judgment of the said production of thyme and the name assigned it; and entertains a difa different opinion almoſt in every reſpect; particularly, that this dry body, produced from the diſtill'd oil of thyme, which the Dr. took for a ſpecies of camphire, and conſequently gives it the name of the *camphire of thyme*, is no camphire, and does by no means deſerve that name: The Dr. therefore explains himſelf farther as to what he had formerly deliver'd on this head, little ſollicitous whether the production be taken for a camphire, or with Mr. *Brown* for an oil.

Mr. *Brown* ſays 1. That this production of thyme is not camphire, but the coagulated or condenſed oil of thyme. 2. He grounds this upon ſome experiments, in which the common *Indian*, and ſhop camphire is different from that call'd camphire of thyme; and conſequently, that this production is not camphire. And tho' the Dr. has nothing to object to the experiments adduced by Mr. *Brown*, which point out a diſtinction; yet the differences, obſerved by Mr. *Brown*, between the common camphire and the camphire of thyme, are not ſufficient, he thinks, to convince him, that this production of thyme is not therefore camphire.

In the above-mentioned obſervation the Dr. had aſſerted, firſt in general, 'that he had got from common thyme, a true, 'denſe, cryſtalliform, camphire, agreeing with it in all its qualities, and only differing in ſmell, &c.' in particular he advanced, '1. In what manner he obtain'd this camphire. 2. His 'reaſons for taking that ſubſtance for a camphire. 3. What 'parts camphire conſiſts of. And in fine; 4. That he takes 'this camphire of thyme to agree with the common camphire 'in all the principal qualities, excepting the ſmell.'

Mr. *Brown*, it is true, owns that this preparation or production exiſts, affirming, that ſome ſuch thing had been obſerved before in *England*, which the Dr. does not contradict; tho' for the whole 5 years he liv'd there, he never heard of it, much leſs ſaw it with his own eyes; and ſo Mr. *Brown* grants its external form, and only objects to the name, or that it is camphire: And thus he differs from the Dr. in ſome other things.

That this preparation of thyme could be reckon'd no other than camphire: The Dr. was induced to think from the following reaſons: 1. It is got from an eſſential oil. 2. It is entirely white, tranſparent, pellucid, cryſtalline, dry and hard, yet friable; and in fine, a ſtrong ſcented body. 3. In water indiſſolvable. 4. On the contrary, eaſily diſſolv'd in highly rectified ſpirit of wine and ſpirit of nitre. 5. The manifeſt conſtitutive parts of this production of thyme are the ſame as of common

camphire

camphire; tho' with respect to its specific smell, the proportion of its constituent parts, its native place or climate, there may be a remarkable difference, and from thence likewise various subtile differences may arise about its commixture and relation with other things. And in fine; because he could not give a mixed substance thus constituted any better or more proper name, from all the natural and artificial species hitherto known, about which chemistry is conversant, than that of camphire: Since it could not be called either a volatile, or fixed, salt, an earth, stone, condensed juice, bitumen, gum, rosin, sulphur, flowers, precipitate, sublimate, pitch, wax, phosphorus, glass, ice or grit: Much less could he call this hard, dry, and crystalline, body, by the name of any soft unctuous substance; and least of all by the name of any thin fatty or oleose, or humido-liquid matter; since it is neither a balsam, liniment, *coagulum*, butter, oil, fat, spirit, water, wine, liquor, vinegar, or any such thing: And thus he could not think of any one thing fitter and more proper than camphire, with which more justly to compare it, or more properly express it.

On account of the properties of these crystals already mentioned, the Dr. was induced to call them a camphire; and to distinguish this camphire from the common sort and other species thereof, to design it the camphire of thyme: and he at the same time affirmed, that it agreed in all the aforesaid properties with the *Indian* camphire of the shops, tho' he did not then take into the account all its peculiar qualities, relations effects, distinctions and minuter subdivisions; especially since he had not obtain'd so great a quantity of it, as could enable him to set about the enquiries requisite for such experiments; not to mention, that, as he afterwards learned from experience, the *European* vegetables in general yield but a little of this sort of camphire, and but such of them as are naturally dispos'd to yield any quantity of it.

1. That these chrystals of thyme are a camphire, and not an oil, as Mr. *Brown* would have them, appears from the following very remarkable and evidently different circumstances.

1. These crystals are dry to the touch, and consequently not soft, unctuous or fatty, but plainly crystalline, and divided: properties alone sufficient for rejecting the name of an oil.

2. Mr.

2. Mr. *Brown* endeavours to ſupport his appellation by the term *coagulated*, aſſerting that they are a *coagulated oil*.

To this the Dr. replies, that here ſuch an epithet is not ſufficient; 1. Becauſe that, in the whole compaſs of chemiſtry, the word *coagulated* never can, nor ought to be attributed to a dry and cryſtalline ſubſtance: On the contrary; 2. It is only to be aſcribed to ſuch things and circumſtances, in which either inſtanteouſly or gradually, from more or fewer degrees of moiſture, from a thin liquid fat, whether naturally ſo or by the addition of another ſubſtance, ſomething collect's itſelf by precipitation, and aſſumes the conſiſtence of coagulated milk, *offa alba Helmontii*, of a *Rob*, butter, unguent, or a reſinviſcous ſubſtance, be the production afterwards either ſaline, earthy, fatty, reſinous, or what it will. So long as the name *coagulum* or *coagulated* is uſed thereto, it cannot be a dry ſubſtance, but a humido-pingueous, a reſino-viſcous matter. And even ſuppoſing the word was wreſted to expreſs ſubſtances of a dry conſiſtence, tho' hitherto not introduced into chemiſtry; it muſt at leaſt be granted, that it is never to be extended to a pellucid, cryſtalline body that conſiſts of ſeparate, tranſparent, dry, regularly compos'd particles, like a cryſtalline ſalt and continuing hard till detonation. 3. All coagulated oils, as of aniſe, rue, olives &c, if coagulated to the higheſt degree in a cold place, or in winter, do by no means turn to dry, hard cryſtals, like vitriolated tartar, nor into ſtill larger cryſtals like white ſugar-candy, and conſequently, ſonorous upon ſhaking them; but at moſt into particles that externally reſemble very fine leaves, yet feel fatty to the touch, and appear reged, as it were; beſides, for the moſt part they uſually degenerate into a permanent butyraceous or adipoſe conſiſtence; and conſequently, never into the hardneſs of camphire. 4. Coagulated oils, with the leaſt degree of heat, do immediately run, become thinner, and uſually loſe their ſtate of coagulation; which does not hold of the aforeſaid cryſtals, becauſe they equally continue ſolid, both in ſummer and winter, nay, even tho' you apply a gentle degree of heat.

3. Mr. *Brown* uſed the term *condenſed*, calling the cryſtals, a coagulated or condenſed oil. Had he ſaid, that the cryſtals are a body condenſed from oil, he would then fall in with the Dr's. opinion: But as he ſimply takes them for an oil, this cauſes a wide difference: To ſay that a thing is produced

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condenſed or ſeparated from oil, denotes a different thing from ſaying a condenſed or coagulated oil; by the latter expreſſion we mean entire oil; but by the former, ſomething ſeparated, produced a-new, and ariſing from oil, and appearing to the eye quite different from the reſt of the oil: Oil which ſuffers a coagulation or condenſation, does ſo not only in the 100th, 50th, or 20th part thereof, but in its whole entire bulk; and if not entirely, yet at leaſt in its greateſt part. But how does it happen, that here in the oil of thyme there only ariſeth or is ſeparated a ſmall quantity of theſe elegant cryſtals, and the reſt of the oil not to ſhew the leaſt change, or appearance of coagulation or condenſation, but equally continues of a perfect liquid, and thin oleaginous conſiſtence, as pure oil of thyme commonly does. The matter, from which ſomething is produced, differs from the thing produced from it: We have before us an eſſential diſtill'd oil; but when an entire new ſubſtance doth ariſe, is generated, or ſeparated and produced from it differing in touch, appearance or external form, ſuch a clear, pellucid, white, ſolid and cryſtalline body can never be taken for the former duſkiſh red, thin and liquid oil; and ſo much the leſs, as the whole quantity of oil is not coagulated or condenſed, can that ſubſtance be taken for a coagulated or condenſed oil, tho' ſeparated and condenſed, or rather cryſtalliz'd from oil. And ſhould the method prevail of calling the ſubſtances ſeparated and prepared from this or that ſubject by the name of the ſubject itſelf, with the addition of ſome adjunct, what ſurpriſing concluſions and ſtrange diſorders would thence ariſe in chemiſtry; and our accounts and deſcriptions of artificial things would be almoſt nothing other than equivocal, obſcure, and uncertain. And ſhould camphire be call'd an oil, only becauſe it is produced from an oil, and from its conſiſtence and figure only have the adjunct *coagulated* or *condens'd* ſuperadded thereto; with the ſame propriety common malt ſpirits might be called *liquid corn* or *ſeed*, *rarefied barley*, *ſpirituous wheat*, &c. becauſe prepar'd from ſuch grain. In like manner, the flowers of antimony might likewiſe be call'd volatile antimony; the ſpirit of ſulphur, aqueous ſulphur; phoſphorus, coagulated urine; lixivious cryſtalline ſalt, condenſed aſhes; and thus many other things ſhould be call'd by the name of the ſubſtance from which they are prepar'd; becauſe as to all theſe it may with equal juſtice be prov'd, that they are produced or prepar'd from them, as as that camphire of thyme; is produced from the oil of thyme; and thus several matters might be differently and more prolixly denominated: Unless, we likewise had regard to external differences, as consistence, appearance, dryness, moisture, fatness, liquidity, pellucidity oppacity, solidity, hardness, softness, and several other circumstances; and at the same time considered how to express ourselves in the most concise and distinct manner.

If, therefore, any thing can be properly express'd by one single characteristic term, it is ridiculous to make use of 2 or more terms; and consequently instead of the word *camphire*, to call it *coagulated* or *condensed oil*: any one understands the meaning of the word *camp hire*, as that it denotes a crystalline and condensed body, nay, as condensed from oil, and mostly consisting of oleaginous parts, &c. Besides, there are different methods in chemistry, wherein a dry body is got from a liquid substance; and consequently we are here to make a distinction, and not to describe every thing by the words, *coagulated* and *condensed*; since there is no small difference between the terms *coagulated* and *crystalliz'd*, *congeal'd*, *condensed*, *inspissated*, *precepitated*, *sublimated*, &c.

This, therefore, is the Dr's. explication, and the reason, why he call'd these crystals, camphire, and not an *oil*, or by any other name: As to the rest, it matters not whether Mr. *Brown* and others call them an oil or volatile salt, or what other name they please to give them: Besides the Dr. is not the first or only one who call'd such a mixt, got from European essential oils, by the name of camphire, but Dr. *Boerhaave* in his *Chymiæ Institutiones & Experimenta* p. 82. and quoted by Mr. *Brown*, speaks thus; 'Camphire *says he*, is not only produced from the camphire tree alone, but *which is remarkable*, 'all aromatic plants may yield a camphire of their own kind: 'And Dr. *Boerhaave* frequently in his Colleges and lectures, 'explain'd himself further on these *European* oils from which 'camphire may be got: And the learned and experienced 'Chemist M. *Geoffroy*, the younger, (whom M. *Brown* also 'quotes) in the *Mem. of the Royal Academy of Sciences* for 'the year 1721, speaks to the following purpose: Oil of 'turpentine, tho' rectified, deposites upon the sides of the 'bottle crystals like sublimed camphire: I have observ'd the 'same thing in the essences of mother-wort, marjoram, &c. 'And farther: 'Oil of sage, for instance, and rosemary assume 'in time the same smell nearly: And sometimes even some of theſe approach to that of camphire. I myſelf had ſome ſage-water, which, kept upwards of a year, had acquir'd a very ſtrong ſmell of camphire, ſo that one would have taken it for water, in which camphire had been quenched, &c.'

And if M. *Brown* will not admit of the experiments and accounts of ſuch great Men, but ſeem to doubt of them, much leſs will he thoſe of many others, by whom it appears, that camphire was got, not only from ſeveral parts of Eaſt-India vegetables, beſides the tree, properly ſaid to yield camphire, as from the root of the cinnamon-tree, from zedoary, the mint of ſweet ruſh of zeylon and from, ſouthernwood, milefoil, cardamom, juniper, &c; but likewiſe from *European* ſage, roſemary, hyſſop, marjoram, &c. For, tho' Mr. *Brown* thus expreſſes himſelf: 'But I do not 'remember ever to have ſeen any thing of this kind in 'any other oils, excepting oil of thyme and mace'd: of which laſt he ſpeak thus: 'There appears ſomething of a 'cryſtalline form floating on the upper part of this oil; yet 'of what kind, whether camphire or not, time will ſhew.' Yet other people have ſeveral times ſeen and obſerv'd ſome ſuch thing; it is, therefore, no argument, that what Mr. *Brown* has not ſeen, no body elſe ever ſaw; nor that any ſuch thing never did, nor could happen; much leſs, that every thing is entirely falſe, that Mr. *Brown* has not ſeen and verified. He owns indeed, that Mr. *Maul* ſhew'd him camphire of marjarom; but becauſe it did not appear in every reſpect the ſame as common champire, he does not call it camphire, but coagulated oil.

Mr. *Brown* ſeems in ſome meaſure to doubt, or to ſpeak more properly, to be in ſuſpenſe about his own opinion: when he ſpeaks thus: 'As to this *ſalt*, or coagulated oil 'of thyme, &c. And again; To which it will be proper, to 'ſubjoin ſome teſtimonies to this purpoſe about coagulated 'oils, or *ſalts* produced from oils.'

From his calling the cryſtals in queſtion, a ſalt or oil, a coagulated oil or ſalt produced from oil, he is in doubt, that theſe cryſtals are other than an oil; and perhaps, with equal reaſon, a ſalt as well as an oil. Tho' about the beginning of his Diſſertation, he deny's them the name of a ſalt; when he ſays, 'which hitherto, have been improperly 'call'd the volatile ſalt of thyme.' His doubt about this matter may be gather'd more clearly from his adducing teſtimonies of of there learned men, Dr. *Slare*, *Helmont* and Dr. *Boerhaave* : That Dr. *Slare* call'd the camphire of thyme a volatile ſalt, (tho' it admit of no ſolution in water, by which general teſt alone it is excluded from that claſs) as alſo that ſome precipitated ſalt was obſerv'd in the oil of cinnamon, which yet could be no other than camphire; becauſe he himſelf adds, that this oil was without any addition or art diſtill'd to a ſalt : On the contrary the inſtances from *Helmont* and *Boerhaave* do not anſwer to this ſubject, or prove a native volatile ſalt, or ſalt like camphire, ſince they ſpeak of a different real ſalt, namely of a volatile artificial ſalt ; *i. e.* of a volatile ſalt produced from oil and an alcaline fixt ſalt, as Mr. *Brown* himſelf alledges ; *Helmont*, ſays he, ſpake thus of a ſalt made by art from the ſame oil ; 'but when oil of 'cinnamon is mixed with its own alkaline ſalt &c.' And ſo in like manner that ſalt or *ſapo* (as Dr. *Boerhaave* calls it) alledged from *Hombergs* experiment, muſt be ſome true volatile ſalt, mix'd with ſome alcaline ſalt, if it was really ſoluble in water : But if of itſelf and without any addition it ſhot into a ſalt, it could an certainly be nothing other than camphire; and conſequently, no ways ſoluble in, nor commiſſible with water ; whence Dr. *Boerhaave* adds. But we cannot eaſily imitate the experiment ; *i. e.* if without addition we would obtain a volatile ſalt, ſoluble in water, or a *ſapo*.

Dr. *Neuman* gave a definition or deſcription of the compoſition or conſtituent parts of camphire, as that it conſiſts of an inflammable and igneſcent principle, or rarefied phlogiſton, *i. e.* a ſubtile ſulphureous ſubſtance ; which principle ſome ſimply call ſulphur, in a large ſenſe, but others, as *Beccher* and *Stahl*, a ſulphureous, inflammable earth ; or a ſecond earth, igneſcible and phlogiſtic ; but generally it is wont to be expreſs'd by the ſingle term φλογιςον.

This deſcription Mr. *Brown* underſtood, as if the Dr. held, that this camphire could ſtand or reſiſt the fire ; from which it appears that he had not read Dr. *Stahl*'s writings ; and conſequently had no juſt notion of the term phlogiſton, ſo common in that author.

We at length come to conſider the differences, obſerv'd by Mr. *Brown*, between the camphire of thyme and the common ſort ; and which undoubtedly induced him to reject the cryſtalline ſubſtance obtain'd from oil of thyme, as a camphire ; and that becauſe, when mixt with other things, it did

did not agree with the common ſort in all reſpects, but appear'd a quite different thing.

Now the Dr. makes no manner of doubt of the truth of Mr. *Brown*'s obſervations, but frankly owns, that if the camphire of thyme is to be conſidered, according to the reſt of its relations to other bodies, it may conſiderably differ from the common ſort; but the Dr. never intended to extend it ſo far, but rather to conſider its primary properties, and ſuch principally as were moſt obvious to ſenſe; and by which the common camphire as well as the camphire of thyme are diſtinguiſh'd from all other mixts, being little ſolicitous about its other differences and peculiar qualities; nor could he (as has been already ſaid) with the ſmall quantity he had then obtain'd, accompliſh any farther enquiries on it.

The reaſons that induced the Dr. to compare the camphire of thyme with that of the ſhops are theſe. 1. The camphire of thyme is got from an eſſential oil, as is alſo common camphire. 2. It is a dry ſolid body; and ſuch is common camphire. 3. It is friable, as is alſo common camphire; tho' Mr. *Brown* deny this friability. 4. It is white, and ſo is camphire. 5. Clear and pellucid; in the ſame manner as camphire. 6. It conſiſts of divided cryſtals; and in like manner does crude, unpurified, camphire. 7. In ſmell it ſtrongly reſembles that of its own oil or ſpecies; and ſo does camphire. 8. It is not ſoluble in water, any more than common camphire. 9. On the contrary, it is entirely and eaſily diſſolv'd in rectified ſpirit of wine; and this likewiſe is known to hold of common camphire. 10. It is likewiſe diſſolv'd by ſpirit of nitre, and ſo is camphire. And the Dr. indeed, thought ſuch correſponding circumſtances ſufficient at the very firſt, to call ſuch a ſubſtance camphire. But he made mention of a general difference, namely, that from the true camphire-tree, a greater quantity of camphire than oil is got; whereas on the contrary, *European* vegetables yield a great deal of oil, but little camphire: To which now the Dr. farther adds, becauſe *European* camphires conſiſt of a great deal of oil, and a ſmaller portion of camphire, conſequently ſuch are more oleaginous in their compoſition; or with reſpect to the common oriental camphire, more ſaturated with oleaginous particles, and not ſo firmly united with the other parts. But the camphire of the ſhops, as to the proportion of its ingredients, has fewer oleaginous particles, but on the contrary more earthy ones; and in this latter,

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all the conſtituent parts in general are found to be more firmly and better incorporated; that from thence likewiſe in mixing it with other liquors, and with regard to its ſublimation, its ſolution with oil of vitriol, its exhalation, precipitation and other relations, a conſiderable difference may the more eaſily be diſcover'd between theſe two ſpecies: Yet from thence it does not follow, becauſe camphire of thyme does not agree with the common ſort in every reſpect, that therefore, this production from thyme is not camphire: For, in chemiſtry ſhould we ſolely regard the particular differing relations of things, and not take into the account the general and more remarkable properties in which they agree, and from the former draw concluſions, we could then indeed, compare together but a very few things, our judgment about a great many would be too prolix and incoherent.

The Dr. gives an inſtance in metals and ſalts. 1. It is well known, that gold, ſilver, copper, iron, tin and lead, are reckoned perfect metals, and quickſilver an imperfect one; and that becauſe theſe ſubſtances poſſeſs the chief properties of the thing call'd metal; conſequently, they connot be compared with ſtones, earths, ſulphurs, bitumen's, ſalts, glaſs, or any other thing; and in ſhort, with nothing better than metals; as camphire of thyme could not, according to the abovementioned properties thereof, be claſſed with any thing more properly than camphire, and accordingly denominated: But according to Mr. *Brown*'s way of reaſoning, the above metals would not in all reſpects be really metals, nor denominated ſo; becauſe they do not agree with one another in all their relations and commixtures with other things, nor in their ſolutions, precipitations, ſublimations, &c. And he might argue thus; I take gold to be a true metal, becauſe it diſſolves in *aqua regia*; but as ſilver can not be diſſolv'd therein, it is, therefore, no metal. Again on the contrary, ſilver, and ſome other metals, ſoluble in *aqua fortis*, are true metals, but gold not ſo, becauſe it admits of no ſuch ſolution in *aqua fortis*. Spirit of vitriol diſſolves iron and copper, but neither gold nor ſilver; theſe two noble metals would therefore be no longer metals. And this is exactly Mr. *Brown*'s method of reaſoning on the camphire of thyme, with regard to ſolubility, when he ſays; ' oil of vitriol diſſolves common camphire, but not the camphire of thyme; therefore, this preparation of thyme is no camphire.'

2. He

1. He might object the different colour and consistence of the solutions: For, spirit of nitre dissolves this or that metal of a white colour, and the solution appears clear and pellucid: But because the solution of copper is greenish, that of iron an exceeding duskish red, and that of tin not entirely and always pellucid; and these latter solutions are widely different from those of pure silver, mercury, &c. Such solutions therefore, as appear evidently different to the eye, are thicker, and in part not pellucid, are not solutions of metals; or the dissolv'd matters are not metals. For, in this manner does Mr. *Brown* conclude of the solution of camphire of thyme in spirit of nitre: Because its solution has not the same colour, consistence or pellucidity with the solution of common camphire; camphire of thyme is therefore, no camphire: Whereas he ought to have consider'd, that, in the first place, spirit of nitre, as to colour and pellucidity, produces different colours and causes manifold varieties in some metals. 2. That since camphire of thyme is got from a duskish red oil, and besides, is greatly saturated with oleaginous particles; from thence also a much darker and thicker solution may easily be produced.

3. As to precipitation, or the other relations of these solutions, Mr. *Brown* might object a good deal; since there occur many more differences between these, than between the two camphires. As to any farther relation of the solutions of metals one might object thus; a solution of silver, lead and mercury in spirit of nitre yields true crystals; whereas a solution of lead and tin with spirit of nitre yields none; therefore, the former only, and not the latter are metals: A solution of mercury in the concentred acid of common salt by sublimation yields a crystalline salt, but other metals not so; therefore, mercury alone is a metal. Some metals in solution emit a strong fume; but others not. Some metals in solution precipitate something to the bottom of the vessel; but others not; therefore, some only are metals, and not the rest. As to precipitation, there is no small number of differences observable in metallic solutions; the dissolved metal being sometimes precipitated, as a pure metallic *calx*: And again there is obtained different *calces*, void of all metallic brightness, and in part hardly reducible. But no one would affirm of these latter, that the matters, from which such *calces* were obtain'd, were not metals, because in precipitation they had not the same appearance; or because they did not precipitate again in the form of perfect bright metals. And yet Mr. *Brown* forms the same con-

conclusion about camphire, and its different precipitations and relations; namely, that the solution of camphire of thyme does not precipitate in the same manner, as the solution of common camphire; therefore, camphire of thyme is no species of camphire, or it does not belong to that *genus* of mixts. Such differences are also found in the solutions, precipitations and the other various methods of treating resinous bodies with spirit of wine; nay from some resinous solutions, a twofold precipitation may be shewn, so that the rosin either immediately separates or precipitates to the bottom of the vessel, or the solution does not duly precipitate, but becomes only turbid, and lactescent; and this in the same solution, with the same solvent, and precipitant: And from such a precipitation, it cannot be concluded, that the dissolv'd substance is not a true rosin.

In the copulation, solution, precipitation, sublimation and crystallization of salts there occur almost innumerable differences, and relations, that often are as distinct as light and darkness, or as opposite to one another. For how widely do acid salts alone differ from each other? And even, when they are united with an alcaline, either fixt, or volatile, salt, and reduced to a neutral state. Novices themselves are not unacquainted with the wide difference betwixt acid and alcaline salts: But who on that score would venture in a manner quite new, and on account of such occasional differences, or because they do not agree in all respects; that therefore this or the other is no salt: As because, it either admits of no crystallization at all, or is not crystalliz'd in the same manner as that other salt; or because it will not sublime, or in its commixture with this or that other matter, not appear in the same manner; or because it precipitates in a different manner, or is not entirely reduced, or will not assume a dry consistence; and a thousand other variations, which might be mention'd, and which really happen in physico-chemical experiments, where salts are intermix'd. But such a method of reasoning is exploded by every body.

Now camphire of thyme has 9 or 10 properties, in which it perfectly agrees with common camphire, as has been shewn above; consequently it possesses the principal properties of camphire: In regard to which, there is no other matter we know of, with which we could more fitly compare this white, solid, pellucid, fragrant, inflammable, beautiful, crystalline body than camphire. In like manner, lead, iron, copper and tin, can be referr'd to no other more proper class than that of metals; vitriol, common salt, alum and nitre to no other class than that of salts;

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because they possess the more remarkable requisite properties of salts, and agree with nothing other more than with them. And yet according to Mr. *Brown*'s way of reasoning about camphire of thyme, it may be objected; that lead, iron, copper, and tin, are no metals, because they cannot stand the fire so well as gold and silver, but may be burnt into a *calx*, fume away in part, and appear in a different manner in solution, precipitation, sublimation, *&c.* And that vitriol, common salt, alum, and nitre are no salts; because they widely differ (not to mention other differences that might be advanced) from a pure acid, or alcaline, salt, or a sublimable sal ammoniac. But, if the aforesaid 4 substances of the mineral kingdom are metals, and referable to no other class with more propriety, and do justly deserve that name, tho' they widely differ from gold and silver: And moreover, if the other saline substances mention'd are true salts, tho' there be no pure acid, or alcaline, salts in nature; and they differ as much from one another, as they do from many other salts: Why should we introduce in the vegetable kingdom a new method of concluding and describing; and on account of some particular properties and differences, deny camphire of thyme to be a true camphire; tho' this concrete of thyme, as to its principal properties agree as well with oriental camphire, as the aforesaid metals do with other metals, or the above salts with other salts. And if we may call lead, tin, copper, and iron, metals; tho' they widely differ from gold and silver, nay from one another; and if we usually call alum and vitriol, salts, tho' they differ much from common, and other salts; why might not this crystalline body have the name of camphire given it, tho' differing in some respects from the common sort.

To conclude, the Dr. once more repeats it. 1. That so long as any thing claims the name of oil, it should be either evidently liquid, or but little thickish, and feel unctuous to the touch. 2. That any thing passing for a coagulated or condensed oil, should be thickish, and not liquid, or but little so; or at most be of the consistence of an unguent, and that in cold weather only; and consequently stiff, yet feel greasy to the touch; and upon applying the gentlest degree of heat, lose again its coagulated form. 3. That whenever we obtain dry, solid and pellucid crystals, appearing in the form of a beautiful and clear vitriolated crystallized tartar, tho' produced from oil itself; nay tho' they consist as to the greatest part of their composition of true oleaginous particles, yet the name of oil immediately ceases, and the adjunct, *coagulated* or *condensed*, can

can no longer juſtify that title; nor is there any neceſſity for uſing ſuch adjuncts, ſince if ſuch a production from eſſential oil be a cryſtalline, dry, body, ſuch as the ſubſtance before us, then the ſingle term, *camphire*, may be ſufficient, and conſequently beſt expreſs what ſort of mixt it is; and that it is no other than a ſpecies of camphire; and thus this our cryſtalliform body remain camphire of thyme.

In a letter to the preſident of the *Royal Society*, dated *Berlin April* 11, 1733 Dr. *Neuman* frankly owns that he intended nothing other but to declare, that a matter unſoluble in water, and which appears in the form of hard cryſtals, either in oil of thyme or other eſſential oil, is by no means a volatile ſalt, much leſs a coagulated oil, but a peculiar concrete ſeparated from ſuch oils; and in ſhort ſuch a mixt, as cannot be more properly deſigned than by the name of camphire.

The ſettling a new Genus of Plants, *called after the* Malayans, Mangoſtans; *by Dr.* Garcin. Phil. Tranſ. N° 431. p. 232.

THE *Mangoſtans* is a kind of pomiferous tree, that grows in the *Molucca* iſlands, whoſe fruit is one of the beſt in the world for eating.

This *genus* has its flower compleat, tetrapetalous, regular, hermaphrodite, containing the *ovarium*: Its *calix* is monopetalous, divided into 4 lobes, roundiſh on the edges, and hollow'd in the ſhape of a ſpoon. The *ovarium* is nearly cylindrical, with a tube upon it cut out in the ſhape of a roſe, which covers it like a little cap. The *ſtamina*, which ſurround it, are ſpherical at the top, and their number 4 times that of the *petala*. When theſe are gone off, the piſtil changes into a round fruit, adorned with its *calix*, and its tube cut in the ſhape of a ſtar, with rays ſquared at the corners: Its *cortex*, which is thick and brittle, incloſes a cavity filled with as many pulpous and juicy ſegments as there are rays in the tube: Theſe ſegments are white, in the ſhape of a half moon, ſticking together, and containing each but one grain of ſeed, which is oblong, ſomething flatted, like an almond, wrapt up in a *tunica*, which is cover'd with a hairy coat of fibres or veſſels, which together with the pulp form the *parenchyma* of a ſegment of the fruit. The leaves of the tree are entire, ſmooth like thoſe of the laurel, and grow oppoſite to each other on the branches. The ſtem of the tree grows up ſtreight to the top of its tuft; and its branches and twigs come out oppoſite to one another like the leaves. Dr. *Garcin* knew but one ſpecies of this *genus*, which

which admits indeed of ſome variation, but without any other mark than what appears in the fruit. Mangoſtans Garciæ, Cluſ. Bont: *Arbor peregrina aurantio ſimili fructu. Cluſ. exot.* 12. *laurifolia Javanenſis C. B. Pin.* 461.

The *Mangoſtans* is a tree of a very moderate ſize. It does not grow above 3 toiſes (about 18 foot) high: Its ſtem runs up ſtreight to the top of its tuft, like the fir: This tuft is regular, in form of an oblong cone, compoſed of ſeveral branches and twigs, ſpreading out equally on all ſides, without leaving any hollow.

The ſtem grows at bottom to the thickneſs of a man's thigh, or about 8 or 10 inches in diameter; it afterwards gradually diminiſhes in thickneſs up to the tuft: Its wood is white, while the tree is growing, but browniſh when felled and dry: Its bark is a little tender, and eaſily ſeparates from the wood; it is of a dark grey colour, and ſlit or full of cracks up the ſtem; but on the twigs it is more even and green, reſembling that of *evonymus*, or ſpindle-tree.

The branches grow out of them by ſtories, and oppoſite to one another: Thoſe ſtories croſs each other obliquely, and not at right angles. The thickneſs of thoſe branches is always proportionable to that of the ſtem, at the place where they come out: This proportion is about 1 to 4, or 1 to 5. The length of the inferior branches of the tuft is 5 or 6 feet; the others ſhorter as they come near the top: The diſtances of the ſtories of the branches are a little unequal; but where they are wideſt, they do not exceed the length of the greateſt leaves, that is, 8 or 9 inches.

The twigs grow on the branches in the ſame order as thoſe do on the ſtem, that is, oppoſite to each other: The longeſt are commonly of the length from one's hand to the elbow. The larger twigs grow out to a certain diſtance from the ſtem; and the others, which garniſh the reſt of the branches, always grow leſs and leſs towards their extremity. The branches and twigs never divide themſelves.

The leaves are large, entire, beautiful, ſmooth, of a ſhining green on the upper ſide, and of an olive colour on the back, pointed at their extremities. The rib which divides its extent into 2 equal parts, is ſtreight, and equally prominent on both ſides. From the ſides of this rib there iſſue forth fibres pretty ſmall, and almoſt by pairs, which extend themſelves in parallels, and bent a little archwiſe quite to the edge of the leaf, where they unite into a thread, which forms there a kind of margin.

margin. The mafhes, and filaments, of the net, are not very perceptible: The fize of thefe leaves varies; the largeft are 8 or 9 inches long, but commonly 7. The breadth of each leaf is nearly equal to half its length; which proportion is always the fame in every leaf. Their pedicles are thick, fhort and wrinkled, flat on the infide, and rais'd in the fhape of an afs's back on the outfide, moft frequently half an inch long. They come out near, and on the extremities of the twigs, oppofite to each other like the branches themfelves. There feldom appear above 2 pairs of leaves on each twig; and thofe that fhoot out laft always form the extremity of that twig.

The flower is 2 inches in diameter, pretty much like a fingle rofe; it is compofed of 4 *petala*, almoft round, or a little pointed, about an inch broad, very thick, firm, flefhy, brittle, and fomewhat hollow'd into the fhape of a fpoon: Their greateft thicknefs is near their bafis, upwards of a line, which decreafes by degrees towards the extremity: They entirely refemble the *petala* of a rofe, only that inftead of being indented like a heart, they terminate gradually in roundifh points, as has been faid; their colour is alfo like that of a rofe, only that it is deeper and lefs vivid; the bafis which is the thickeft and firmeft part, is the whiteft, and the moft brittle.

The *piftil*, or *ovarium*, is a round, or almoft cylindrical, body, 5 lines thick, rais'd 4 lines high: The upper part of this *piftil*, that is, its tube, is cut in the fhape of a fmall rofe, covering the *ovarium* like a cap: The diameter of this cap is of the fame breadth with the *ovarium*, which it covers entirely, fticking very clofe to it. The colour of the *ovarium* is a pale or whitifh green, and that of the tube a fullied or dirty white.

The *ftamina* rife from the bafe of the *piftil*; they are whitifh, round at the tops, and rais'd to the circumference of the tube, applying themfelves to the *ovarium*: They are 16 in number; 4 for each *petalum*.

The *calix* is of one piece, expanded and cut into 4 lobes down to its bafis; thefe lobes are thick, round, fkinny, hollow'd in the form of a fpoon, and likewife refembling *petala* of rofes not fully blown: They feem to crofs one another like the *petala*: The 2 upper lobes are fomething larger than the lower ones; they are greenifh on the outfide, and of a fine deep red within, which makes them more agreeable to the eye than the *petala*; the red of the upper ones is more lively than that of the lower ones. In fhort all thefe lobes are hollower

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than the *petala*; they do not cover thoſe latter farther than half way their height: This *calix* incloſes all the parts of the flower: It is ſupported by a pedicle 7 or 8 lines in length; its thickneſs being commonly $\frac{1}{3}$ of its length: This pedicle is green, and conſtantly comes out of the end of a twig above the laſt pair of leaves.

The fruit is round, of the ſize of a middling orange: Its bigneſs however varies very much, from 1 inch and $\frac{1}{2}$ to 2 inches and $\frac{1}{2}$ in diameter. Its top is cover'd with a ſort of cap emboſs'd, cut out in the ſhape of a roſe, or a ſtar with rays ſquared off, the breadth of a finger, or ſometimes an inch in diameter. The rays of this little roſe are moſt commonly 6 or 7 in number, but ſeldom 5 or 8. Theſe rays by being thus ſquared form together a kind of polygon; this is the part which had ſerved for the tube to the *ovarium*.

The body of this fruit is a *capſula* of one cavity, compos'd of a thick ſhell, and brittle, ſomewhat like that of a pomegranate, but ſofter, thicker, and fuller of juice: It is commonly 3 lines thick, the colour on the outſide of the caſe is a dark brown purple, mixed with a little grey and dark green; that on the inſide of a roſe-colour; its juice is purple; this ſkin is of a ſtyptic or aſtringent taſte, like that of a pomegranate, nor does it ſtick to the parts of the fruit it contains: The inner part of this fruit is a furrow'd globe, divided into ſegments, much like thoſe in an orange, but of unequal ſize, and not adhering to one another: The number of theſe ſegments is always equal to that of the rays of the tube which covers the fruit: The fewer there are of theſe ſegments, the bigger they are: There are often in the ſame fruit ſegments as big again as any of thoſe on the ſides, as may eaſily be ſeen in Fig. 7. Plate XII.

Theſe ſegments are white, a little tranſparent, fleſhy, membranous, fibrous, full of juice like cherries or raſberries of the taſte of ſtrawberries and grapes together: Each of the largeſt ſegments incloſes a grain of ſeed of the figure and ſize of an almond ſtripped of its ſhell, having a protuberance on one of its ſides, which is nothing elſe but its navel: This grain is cover'd with 2 ſmall ſkins, the outermoſt of which ſerves for a baſis to the filaments and membranes of which the pulp is compoſed: The ſubſtance of theſe grains, as to conſiſtence, colour and aſtringent quality, comes very near to that of cheſnuts. The *calix* always remains ſticking to the fruit, to which it ſerves for an ornament, and when half dried up, it is of the colour

colour of the pomegranate ſhell on the outſide. It covers about $\frac{1}{6}$ part of the circumference of the fruit.

Garcias, *Cluſius* and *Bontius*, are the firſt authors who make mention of the *Mangoſtans*; but they have left us but indifferent deſcriptions, and ſo ſhort, that it is not poſſible to form from them a ſufficient idea for diſcovering its characters: The firſt of thoſe authors was ill informed, as to its fruit being yellow. *Cluſius* has ſpoke of it under 2 different names, without apprehending that it was one and the ſame plant. The figure he has given of the fruit, and which he calls *arbor peregrina aurantio ſimili fructu*, tho' ill executed, yet repreſents it enough to know it again. If in that figure the fruit appear ſmall with reſpect to the twig that ſupports it, this can be for no other reaſon; but becauſe he receiv'd from the *Indies* ſome of that fruit which had been gather'd before its ſtate of perfection, and after which he drew his figure. And hence it is, that the fruit being ſhrunk up and imperfect, he found nothing in it but a few ſhrivell'd grains, not much bigger than thoſe of a fig.

It is, however, ſurpriſing, that the moſt delicious fruit of all the *Indies*, and which yields to none of the beſt in *Europe*, is that which hitherto has been leaſt known: But as M. *Garcin* has often eat of it, and found it as excellent, as it is reputed in the countries where it is cultivated, he reſolv'd to examine its *genus*, ſettle its characters, and give a deſcription of it, which might for the future make it better known to botaniſts, and other curious perſons.

This tree originally grows in the *Molucca* iſlands; but for ſome years paſt it has been tranſplanted into the iſle of *Java*; and there are ſome few at *Malacca*, in which places it thrives very well: Its tuft is ſo fine, ſo regular, ſo equal, and the appearance of its leaves ſo beautiful, that it is at preſent looked upon at *Batavia*, as the moſt proper for adorning a garden, and affording an agreeable ſhade; yet there have been but few *Europeans* in the *Indies* who have made uſe of it for this purpoſe; becauſe they were unacquainted with it.

Travellers, who make mention of its fruit, always ſpeak of it with great encomium's: *Linſchooten* is the only one, who, after having given a deſcription of ſeveral *Indian* fruits after his way, thought it needleſs to deſcribe the *Mangoſtans*, as well as ſome others; becauſe, ſays he, they are little valued: Probably, he never ſaw it; but upon enquiry took upon credit what

what ſome perſon or other told him, who knew nothing of it beſides the name, and confounded it with others, which are little eſteemed.

There are few ſeeds to be met with in this fruit, that are good for planting; for, moſt of them are but abortive. Sometimes this fruit is found ſpoil'd within, which may be known by yellow ſpots appearing on ſome of the ſegments: And then ſome people ſcruple to eat them; but others make no difficulty about it. It is however certain, that they are not ſo good; eſpecially, if the ſpots be conſiderable. M. *Garcin* obſerv'd that this corruption proceeded from the juice in the *capſula*, which being ſpoil'd by the ſting of ſome inſect, and thereby becoming yellow, and ſpreading over the ſegments of the fruit, tinged them of that colour, and thereby changed them. This wound is ſo ſmall, and ſo hard to be diſcover'd, that one is often left in ſuſpenſe, whether there be any at all.

One may eat a great deal of this fruit without any inconvenience; and it is the only one which ſick people may be allow'd to eat without any ſcruple: It is very wholeſome, refreſhing, and more cordial than the ſtrawberry.

Its ſhell has the ſame virtue with that of the pomegranate: At *Batavia* they make an infuſion and a tincture of it againſt looſeneſſes, and chiefly againſt dyſenteries: The wood is good for nothing but fewel.

In the *Memoires de Mathemat. & de Phyſ. de l'Academ. Roy. des Scien. de Paris* for the year 1692, p. 435. *Amſterdam Edit.* there is a ſhort deſcription of the *Mangoſtans* by F. *Beze*, which is pretty good: But as he took the *calix* for the flower, it is plain, that he did not obſerve it till after the *petala* were fallen off. This deſcription is too ſhort and defective for determing from that alone the true characters of this *genus*.

Fig. 2. Plate XII. repreſents the flower, as it appears in the inſide and outſide; *a* the 4 *petala* of the flower; *b* the 4 lobes of the *calix*; *c* the tube; *d* the pedicle.

Fig. 3. repreſents the *calix* as it appears in the inſide with the *piſtillum* and *ſtamina*; *e* the end of the pedicle of the flower, which ſupports the *calix*.

Fig. 4. repreſents a *petalum* as it appears on the back, ſeparated from the flower; *f* its baſis, which is the thickeſt, firmeſt and moſt brittle part; *g* four *ſtamina* belonging to the *petalum*, ariſing from the baſis of it and the *piſtillum*.

Fig.

Fig. 5. The entire fruit ſeen from the ſide of the *calix* or pedicle; *h* the *calix*; *i* the pedicle; *k* a part of its tube.

Fig. 6. The ſame ſeen from the ſide of the tube, which is cut out in the ſhape of a ſmall roſe; *l* the tube which always ſticks faſt to the fruit; *m* the pedicle and part of the *calix*.

Fig. 7. The fruit cut into two halves, containing 6 ſegments; *n* the ſegments good to eat, of which ſome are commonly larger than others; *o* the *calix*; *p* the pedicle.

Fig. 8. A ſeparate ſegment of the fruit, in the ſhape of a half moon, containing a ſeed.

Fig. 9. A ſeed ſeparated from the ſegment, whoſe coat is covered with filaments, which form the *parenchyma* of the ſegment.

Fig. 10. A leaf of the tree which bears the *mangoſtans*, with its fellow cut off near the bottom, ſupported by a piece of its twig.

A philoſophical and hiſtorical Account of the Aurora Borealis; *by M.* De Mairan. Phil. Tranſ. N° 431. p. 243.

THE frequent appearances of the *Northern Lights* in ſeveral parts of *Europe* and *America*, and the ſurpriſingly beautiful phenomena obſerv'd in ſome of them, ſuch as the rainbow colours, canopy, *&c.* have very juſtly engaged philoſophers in an enquiry into the cauſes of them. Several hypotheſes have been invented and propoſed, in order to explain theſe things. Moſt of them ſuppoſe theſe phoſphorus-like appearances to proceed from certain effluvia, either perſpired out of our earth, or at leaſt paſſing thro' it. But M. *De Mairan* has thought of a cauſe, very diſtant, as well as very different from theſe, *viz.* the atmoſphere of the ſun, which at ſome times ſhews itſelf under the appearance of a light, which he calls the zodiacal light; but at other times produces an *aurora borealis.* The zodiacal light is the purer unmixed atmoſphere of the ſun: But an *aurora borealis* is the effect of the ſolar atmoſphere, conſequent upon its making a deſcent into, and blending itſelf with the atmoſphere of our earth, at certain times and ſeaſons of the year.

M. *De Mairan* has conſulted the accounts of meteors, from the fifth century down to the preſent time, in the hiſtorical part; and ranged them in regard of the ſeveral returns of this

this phenomenon: By a return he does not mean barely a ſingle appearance, but a ſeries of them after a ceſſation or non-appearance for ſeveral years. Thus he makes but 22 returns from the year 400 to 1716; while the ſeveral appearances of theſe lights from 1707 to 1710, after a ceaſing to appear for 20 years, are reckoned but one return.

The *aurora borealis* is a luminous phenomenon, ſo call'd from the place of its appearance, uſually in the northern parts of the heavens, and with a light near the horizon, like that of the morning dawn. This name is ſuppos'd to be given it firſt by M. *Gaſſendi*; but it appears otherways from a place in his animadverſions on *Diogenes*.

The cauſe of an *aurora borealis*, in general, M. *Mairan* takes to be a light call'd the zodiacal light; which, in reality, is nothing other than the atmoſphere of the ſun ſpread on each ſide of him along the zodiac, in the form of a pyramid. This is ſometimes extended to ſuch a length as to reach beyond the annual orbit of our earth; and in theſe circumſtances ſometimes to blend itſelf with our atmoſphere; and being of an heterogeneous nature, produces the ſeveral appearances, which are obſerv'd in, and uſually compoſe the *northern lights*.

That the zodiacal light, or ſun's atmoſphere, is very different from the ambient æther, M. *Mairan* thinks evident, in that the æther reflects none of the ſun's light, is exceeding rare, and altogether imperceptible. Whether the zodiacal light of the ſolar atmoſphere be any emanation from the body of the ſun, a ſpecies of efferveſcence, or depuration of its groſſer parts, an amaſs of heterogeneous parts, diffuſed in the æther, that meeting from all parts, tend towards the ſun, *&c.* he does not undertake to determine.

It is enough for his purpoſe, that it is of a luminous nature, whether in itſelf, or becauſe ſtrongly illuminated by the rays of the ſun, whoſe body it environs. He does not deny but that it may alſo be of an inflammable nature; nay actual flame or fire, tho' very fine and rare.

He obſerves, that the form, in which the ſolar atmoſphere is commonly ſeen in total eclipſes of the ſun, is round, tho' ſometimes conical: At all other times it moſt uſually preſents itſelf to us in the form of a lucid pyramid, or lance, lying oblique to the horizon, along the zodiac; and for that reaſon call'd by M. *Caſſini*, the elder, the zodiacal light. Mr. *Childrey* in his hiſtory of the natural and artificial rarities of *England* deſcribes

describes it thus: 'There is one thing which I must needs 'recommend to the observation of mathematical men, which 'is, that in *February*, and for a little before, and a little 'after that month, as I have observ'd several years together 'about six in the evening, when the twilight was almost 'departed the horizon, you shall see a plainly discoverable 'way of twilight, striking up towards the *Pleiades*, and 'seeming almost to touch them. It is to be observ'd any 'clear night, but it is best seen *illuni nocte*. There is no 'such way to be observ'd at any other time of the year, that 'I can perceive, nor any other way at that time to be per- 'ceiv'd darting up elsewhere; and I believe it has been, 'and will be, constantly visible at that time of the year: But 'what the cause of it in nature should be, I cannot yet 'imagine, but leave it to farther enquiry.'

Upon a farther and closer consideration of this matter, M. *Mairan* takes it to be the solar atmosphere.

And Dr. *Derham* informs us, that about a quarter of an hour after sun-set *April* 3, 1707, he perceiv'd in the western parts of the heavens a long slender pyramidal appearance, perpendicular to the horizon: The base of this pyramid he judged to be the sun, then below the horizon; its *apex* reach'd 15 or 20 degrees above the horizon; it was throughout of a rusty red colour, at first pretty vivid and strong, but the top part much fainter than the bottom nearer the horizon. He did not remember to have ever seen any thing like it, except that white pyramidal glade, now call'd the *aurora borealis*. which resembles it except in colour and length. Again on the 20th of *March* 1715-16 in the evening, he espied a very odd sort of light in the constellation *Taurus*: This glade of light had the same motion that the heavens had, and was much like the tail of a comet, but pointed at the upper end. This light, he doubts not, is such as Dr. *Childrey* first observ'd in *England*; and *Cassini* and others afterwards in *France*.

M. *Mairan* proceeds to give an account of the true figure, extent, situation, &c. of this light, or atmosphere of the sun. Its true figure he judges with M. *Fatio* to be lenticular, and he gives a projection of it upon the plane of the sun's equator, the eye being suppos'd in the axis of the sun, produced thro' his south pole at such a distance, as makes the solar atmosphere appear under an angle of 45 degrees: In it you have a view of the nodes, poles, limits,

declination

declination and extent, paſſing thro' and beyond the orbits of *Mercury* and *Venus*, and in ſome parts beyond the *orbis magnus*. And he demonſtrates its extent from ſeveral obſervations of the elongations of the *apex* of this pyramid from the centre of the ſun; which has been found to be ſometimes double that of *Venus*, and at other times 90 degrees, and once or twice upwards of 100; whereas an elongation of 90 degrees gives the diſtance of the *apex* from the ſun equal to that of the earth at the time of obſervation.

As to the changes, both real and apparent, to which the zodiacal light or ſolar atmoſphere is liable; its length has been for ſome time upon the increaſe, afterwards in a diminiſhing condition; and has been alter'd ſo much in the compaſs of 37 months, as to have been 30 degrees longer at one time than at another. The changes as to luminouſneſs, denſity, and tranſparency, have likewiſe been found to be conſiderable. And ſometimes the zodiacal light has been ſo rare and weak as to be but juſt viſible; afterwards for a long time not viſible at all.

M. *Mairan* obſerves, that theſe conſiderations may ſerve in ſome meaſure to account for the inconſtancy of the *aurora borealis*, as alſo for its non-appearance for ſome years; ſince it owes its original to, and has ſo cloſe a connection with the zodiacal light, whoſe appearance is ſo uncertain: Add to this, the zodiacal light, as he afterwards ſhews, muſt not only be of a ſufficient length and denſity, but the earth muſt be in or near the nodes, formed by the interſection of the plane of the ſun's equator with the plane of the ecliptic.

And as to the ſeveral methods by which mathematicians find the greateſt heights of the atmoſphere, and of the region uſually poſſeſſed by the *aurora borealis*; ſuch as the duration of the twilight, and the height of the mercury in the barometer, M. *Mairan* rejects them as inſufficient for that purpoſe; the atmoſphere being much higher than what has been ever found by them, and conſiſting of a fluid much finer than the groſs or common air, the height of which laſt only is meaſurable by theſe methods.

His method of ſettling the altitude of the *northern lights* is founded upon ſeveral obſervations, made at very diſtant places at the ſame time; and he fixes ſome *auroræ boreales* to be but 100 leagues, tho' others are no leſs than 300; and the far greater number of them about 200 leagues above the ſurface of the earth.

M.

M. *Cramer* computes the height of the *aurora borealis*, ſeen at the ſame time at *Geneva* and *Montpellier*, *Feb.* 15, 1730, to be $\frac{213}{1000}$ of a ſemi-diameter of the earth, *i. e.* about 160 leagues.

M. *Meyer* has propos'd, in the *Memoirs* of the *Academy* of *Petersburg*, a very ingenious method of finding the height and diſtance of a boreal arc from any obſerver, by a ſingle obſervation: M. *Mairan* applies this method to ſuch *auroræ boreales* as were capable of it, and finds that the boreal arcs of ſeveral were no leſs than 100 leagues high.

The *lumen boreale* commonly appears in the northern parts of the heavens; becauſe tho' the whole atmoſphere of the earth be involved in the zodiacal matter, or ſolar atmoſphere; yet it is thrown off both ways from the equatorial towards the polar regions.

This is owing to a double cauſe; the firſt is the centrifugal force, ariſing from the diurnal motion of the earth, which being greateſt at the equator, and gradually diminiſhing as you approach the poles, where it vaniſhes, makes greateſt oppoſition there, and not only hinders the entrance of the zodiacal matter into the earth's atmoſphere, near the equatorial region, but turns it aſide into a courſe towards each pole; and M. *Mairan* does not queſtion but an *aurora auſtralis* might be ſeen at proper times in the ſouthern temperate zone, juſt as an *aurora borealis* is in ours, and attended with ſimilar phenomena, were there but attentive obſervers.

The ſecond cauſe is the progreſſive motion of the earth in its annual orbit near one half of the year with the north pole foremoſt; and in the other half with the ſouth pole, moving thro' the zodiacal matter.

The natural conſequence of which will be a heaping up of matter, more on the polar than the equatorial or temperate regions; and this accounts in part for the declination of the centre of the luminous arches, ſometimes near 10 degrees from the pole; the direction of this motion of the earth not coinciding with the direction of the axis of the earth at thoſe times.

The dark circular ſegment, next the horizon, appearing like a heavy black cloud or miſt, is formed out of the denſeſt and ſpecifically heavieſt parts of the zodiacal matter, which in their deſcent muſt ſink deepeſt into the earth's atmoſphere, and are

leaſt

least inflammable in their nature, while the rarer and lighter parts, which are more inflammable and luminous, if not actually inflamed, form the arch or arches that lie above the dark segment. He speaks of a *fort de l'incendie*, a place where the zodiacal matter collected together, and moving or passing thro' it, is actually turned into flame. Thus long trains of descending zodiacal matter, arriving in their descent at this place, and being kindled, or at least reflecting the light of that *incendium*, produce the several columns or streams of light that appear above, or behind the obscure circular base, or luminous arches.

The breaks, sometimes visible in these arches, are occasion'd by the descent and passage of several discontinued trains and flakes of the denser and least inflammable parts of the zodiacal matter, between the eye of the spectator and the luminous arch.

The various colours arise from a separation of the rays of light from each other, either by a sort of filtration in passing thro' medium's of different densities, or by the divergence of the differently refrangible and colour'd rays; or rather from the different celerities of those rays, after the manner that the colours are formed in clouds near the horizon about the rising or setting sun.

The canopy, *corona* or glory formed in a compleat *aurora borealis*, by a concourse of the rays of the matter of this phenomenon, near the zenith of the place, he takes to be purely optical; a simple appearance arising from a singular distribution of several perpendicular columns, or trains of zodiacal matter. This exactness and regularity in the distribution makes it an uncommon phenomenon: So that among 100 *auroræ boreales* that have been observed, he has only met with 3 attended with a *corona*.

M. *Mairan* takes notice of several appearances in nature, that seem to be explicable by his hypothesis of a solar atmosphere; such as the *nebulæ*, or lucid spots, observed among the fixed stars, the spots in the sun, the atmosphere and tails of comets, &c.

The *nebulæ* are certain luminous spots or patches, which discover themselves only by the telescope, and appear to the naked eye like small fixed stars. They are 6 in number, and accurately described in *Phil. Trans.* N° 347. Some of them have no sign of a star in the middle of them, and are properly *nebulæ*; others have, and then they are call'd *nebulosæ*. They are look'd upon by some to be in reality nothing other than the light

light coming from an immenſe great ſpace in the æther, thro' which a lucid medium is diffus'd, that ſhines with its own proper luſtre, making a perpetual uninterrupted day, by no means owing to the illumination of a central body, or ſtar.

But M. *Mairan* ſeems to be of another mind; and queries thus: Since the fixed ſtars are of the ſame nature with our ſun, may not ſome of them have atmoſpheres ſurrounding them, ſo luminous and extenſive, as to become viſible to us by a light eaſily diſtinguiſhable from that of the central body: And may not atmoſpheres of others be ſo denſe as well as luminous, and extenſive, as may ſuffice to obfuſcate the light of the ſtar involved in it? And are not the *nebuloſæ* of the former ſort, and the *nebulæ* of the latter? The lucid ſpot in *Andromeda*'s girdle, which after *Hevelius* M. *Mairan* continues to call a *nebuloſa*, was found by M. *Caſſini* the elder to reſemble the zodiacal light in ſome circumſtances, and by M. *Kirch* to have ſuffer'd ſome changes, appearing and diſappearing by turns.

M. *Mairan* obſerves by the way, that this ſpot was firſt diſcover'd, not by M. *Bullialdus* in 1660, as is commonly believ'd, but by M. *Simon Marius* in 1612, who fully deſcribes it in the preface to his *Mundus Jovialis*.

The luminous ſpace round the *nebuloſæ* of *Orion's ſword*, diſcover'd and deſcrib'd by M. *Huygens*, M. *Mairan* takes to be an aſſemblage of the ſeveral atmoſpheres of the ſtars, plainly viſible within that ſpace, and probably of ſome others that are conceal'd from our view. The irregularity of the ſhape is no difficulty, it ariſing from the different, and to us ſeemingly irregular poſitions of their atmoſpheres. He adds as a confirmation of his hypotheſis, that the brightneſs and very figure of this ſpace have ſuffer'd ſome alterations ſince M. *Huygens*'s time: That one of the ſtars, delineated by M. *Huygens* without any ſurrounding light, has ſince been found to have a pale light, like an atmoſphere, ſurrounding it.

Is not the ſolar atmoſphere liable to frequent fermentations, and ſubſequent precipitations of its groſſer parts towards the ſurface of the ſun? And are not the different degrees of brightneſs and tranſparency owing thereto? Since the changes in our atmoſphere are not ſufficient to account for the non-appearance of the zodiacal light in ſome convenient ſeaſons and clear nights.

May not the ſpots, of late ſo often obſerved in the ſurface of the ſun, be owing to theſe precipitations of the groſſer parts of the zodiacal light; ſince there ſeems to be ſome analogy or correſpondence between the frequency, ceſſation, and returns, of

theſe

these spots, with the cessation, returns, and appearances, of the zodiacal light?

Are not the inferior planets, *viz. Mercury* and *Venus*, almost always immersed in the zodiacal matter? And may not that be one reason, why it is so difficult to observe spots in them? May not a change in the density, or magnitude of the solar atmosphere, be one reason why the astronomers at *Paris* have not been able to observe those spots in *Venus*'s disk that have been taken notice of, and describ'd by M. *Bianchini* at *Rome*, a little before, since the telescopes at *Paris* were of equal length and goodness?

May not the augmentation of the quantity of matter in the earth and inferior planets by the continued accumulation of the zodiacal matter upon their surfaces, during a course of several ages, produce, among other things, some alteration in their periodicel motions?

May not the atmosphere and tail of a comet be owing to the zodiacal matter, which the comet during its passage thro' the solar atmosphere intercepts, and afterwards carries away with it, in its ascent from the sun?

Is not the earth safe enough from all danger of any inundation, much more of an universal deluge, tho' it should pass thro' the atmosphere, or tail of a comet? Since the effects of such a passage can only be an *aurora borealis*, whose matter is not at all of a watery vaporous nature? A conflagration rather then an inundation might have been imagined to be the natural consequence; but experience informs us, that if this hypothesis be admitted as genuine, our earth has been entirely plunged in this zodiacal matter, without any sensible heat attending it.

Of Electricity; *by M.* Du Fay. Phil. Trans. N° 431. p. 258.

THE writings of Mr. *Gray* and Mr. *Hauksbee* first put M. *Du Fay* on the subject of the electricity of bodies, and furnish'd him with the hints that led him to the following extraordinary discoveries.

1. He found, that all bodies (metallic, soft or fluid ones excepted) may be made electric, by first heating them more or less, and then rubbing them on any sort of cloth: So that all kinds of stone, as well precious as common; all sorts of wood; and in general, every thing he made trial of, was excited by heating and rubbing; except such bodies as grow soft by heat, as the gums, which dissolve in water, glue, and such other sub-

ſubſtances. It is alſo to be remarked that the hardeſt ſtones and marbles require more chaffing or heating than others; and that the ſame rule obtains with regard to the woods: So that box, *lignum vitæ*, and ſuch others, muſt be chaffed almoſt to the degree of burning; whereas fir, lime-tree and cork, require but a moderate heat.

2. Having read in one of Mr. *Gray*'s experiments in *Phil. Tranſ.* N° 422. p. 227. that water may be made electrical by holding the excited glaſs tube near it (a diſh of water being firſt fixed to a ſtand, and that ſet on a plate of glaſs, or on the brim of a drinking glaſs, previouſly chaffed, or otherwiſe warmed) M. *Du Fay* found upon trial, that the ſame thing happen'd to all bodies without exception, whether ſolid or fluid; and that for that purpoſe it was ſufficient to ſet them on a glaſs ſtand, ſlightly warmed, or only dried; and then by bringing the tube near them, they immediately became electrical. He made this experiment with ice, with a lighted wood-coal, and with every thing he could think of; and he conſtantly remarked, that ſuch bodies, as of themſelves were leaſt electrical, had the greateſt degree of electricity, communicated to them at the approach of the glaſs-tube.

3. Mr. *Gray* ſays in *Phil. Tranſ.* N° 417, p. 44. that bodies attract more or leſs according to their colours. This led M. *Du Fay* to make ſeveral very ſingular experiments. He took 9 ſilk ribbons of equal ſize; one white, one black, and the other ſeven of the 7 primitive colours; and having hung them all in order on the ſame line, and then bringing the tube near them, the black one was firſt attracted, the white one next, and the others in order ſucceſſively to the red one, which was attracted leaſt and the laſt of all. He afterwards cut out 9 ſquare pieces of gauſe, of the ſame colours with the ribbons; and having put them one after another on a hoop of wood with leaf-gold under them, the leaf-gold was attracted thro' all the coloured pieces of gauſe, but not thro' the white or black: This at firſt inclined him to think, that the colours contributed much to electricity: But 3 experiments convinced him of the contrary; the firſt, that by warming the pieces of gauſe, neither the black nor white pieces obſtructed the action of the electrical tube more than thoſe of the other colours: In like manner, the ribbons being warmed, the black and white were not more ſtrongly attracted than the reſt. The ſecond is, the gauſe and ribbons being wetted, the ribbons were all equally attracted, and all the pieces of gauſe equally intercepted the action of

electric

electric bodies. The third experiment is, that the colours of a prism being thrown on a piece of white gause, there appeared no differences of attraction: Whence it follows, that this difference proceeds not from the colour, as a colour, but from the substances employed in the dying: For, upon colouring ribbons, by rubbing them with charcoal, carmine, and such other matters, the differences proved no longer the same.

4. Upon communicating the electricity of the tube by means of a pack-thread, after Mr. *Gray*'s manner, he observed the experiment succeed the better for wetting the line; and that it may be supported on glass tubes instead of silk-lines: This experiment he made in a garden at 1256 foot distance, tho' the wind was high, and the line made eight returns, and passed thro' two different walks: By means of two silk loops he adjusted two lines in such a manner, that their ends were but a foot distant from one another, and he remarked that the electric virtue was still communicated: Mr. *Gray* had *Phil. Trans.* N° 426. p. 431 done the same with rods.

5. He suspended a child on silk lines, and made all the surprising experiments described by Mr. *Gray*: But having tried the same experiment on his own body in the same manner, he observed several things very remarkable. 1. When he took the paste-board, or stand, on which the leaf-gold was laid, into his hand, neither his other hand, nor face, had any attraction: But if another person came near him, that other would attract it with his face, his hand, or even with a stick. 2. While M. *Du Fay* was suspended on the lines, if the electric tube was brought near one of his hands, or legs, and then another person approached him, and passed his hand within an inch, or thereabouts of his face, legs, hand or cloaths, there immediately issued from his body one or more pricking shoots, with a crackling noise, causing a little pain in both, like that from the sudden prick of a pin, or the burning from a spark of fire, and as sensibly felt thro' one's cloaths, as on the bare hand or face; and in the dark these snappings are so many sparks of fire: But they are not excited if a bit of wood, cloth or any other matter than a living body be passed over the person suspended on the lines, unless it be a piece of metal, which very nearly produces the same effect. Any other living animal doth the same, if put on the lines, and first the tube and then the hand be applied near it. But it is otherwise if the experiment be made with the carcase of an animal; for, then one only perceives, if it happen in the dark, a still uniform light, without snappings or sparks.

6. On making *Otto Guerike*'s experiment, which is to repel a down-feather by an excited ball of ſulphur, M. *Du Fay* perceiv'd the ſame effects produced not only by the tube, but by all electric bodies whatever: And he diſcovered a very ſimple principle, which accounts for a great part of the irregularities, that ſeem to accompany moſt of the experiments on electricity; which is, that electric bodies attract all thoſe that are not ſo, and repel them ſo ſoon as they become electric, by the vicinity or contact of the electric body: Thus leaf-gold is firſt attracted by the tube, and acquires an electricity by approaching it, and of conſequence is immediately repell'd by it; nor is it re-attracted, while it retains its electric quality: But if, while thus ſuſtained in the air, it chance to light on ſome other body, it immediately loſes its electricity, and conſequently is re-attracted by the tube; which, after having given it a new electricity, repels it a ſecond time, which continues ſo long as the tube keeps its electricity.

Upon applying this principle to the various experiments of electricity, it clears up a number of obſcure and puzzling facts: For, Mr. *Hauksbee*'s famous experiment of the glaſs globe, in which ſilk threads are put, is a neceſſary conſequence of it: When theſe threads are ranged in form of rays by the electricity of the ſides of the globe, if the finger be brought near the outſide of the globe, the ſilk threads within fly from it; which happens only becauſe the finger, or any other body applied near the glaſs globe, is thereby rendred electrical, and conſequently repels the ſilk threads, which are endowed with the like quality: And in the ſame manner may one account for moſt of the other phenomena; which ſeem inexplicable without attending to this principle.

7. M. *Du Fay* hit by chance on another principle, more univerſal and remarkable than the preceeding, and which throws a new light on the ſubject of electricity, and is thus: There are two diſtinct electricities, very different from one another; one, he calls vitreous electricity, the other, reſinous electricity: The firſt is that of glaſs, rock-cryſtal, precious ſtones, hair of animals, wool, &c. The ſecond, that of amber, copal, gum-lac, ſilk, thread, paper, &c. The characteriſtic of theſe two electricities is, that a body of the vitreous electricity, for inſtance, repels all ſuch as are of the ſame electricity with it; and on the contrary, attracts all thoſe of the reſinous electricity; ſo that the tube, made electrical, will repel glaſs, cryſtal, hair of animals, &c. when

when alſo rendred electical; and attract ſilk, thread, paper, &c. tho' rendred electrical likewiſe: Amber on the contrary will attract electric glaſs, and other matters of the ſame claſs, and repel gum-lac, copal, ſilk, thread, &c. Two ſilk ribbons, rendred electrical, will repel each other; two woolen threads will do the like; but a woolen thread and a ſilk thread will mutually attract one another. This principle very naturally explains, why the ends of threads, of ſilk or wool, recede from one another in form of a pencil or broom, when they have acquir'd an electric quality. From this principle one may with the ſame eaſe deduce the explanation of a great many other phenomena.

In order to know immediately, to which claſs of electricity any body belongs, you need only render electrical a ſilk thread, which is known to be of the reſinous claſs, and ſee whether that body, rendred electrical, attracts or repels it: If it attracts, it is certainly of the vitreous kind of electricity; if on the contrary it repels, it is of the ſame kind of electricity with the ſilk, *i. e.* of the reſinous. M. *du Fay*, likewiſe obſerved, that communicated electricity retains the ſame properties; for, if a ball of ivory, or wood, be ſet on a glaſs-ſtand, and this ball be rendred electric by the tube it will repel all ſuch matters, as the tube repels; but if it be excited by applying a cylinder of gum-lac near it, it will produce quite contrary effects, *viz.* preciſely the ſame as gum-lac would produce. To ſucceed in theſe experiments it is requiſite, that the two bodies brought near each other, to diſcover the nature of their electricity, be rendred as electrical as poſſible; for, if one of them was not at all, or but weakly excited, it would be attracted by the other, tho' of that ſort that ſhould naturally be repelled by it: But the experiment will always ſucceed perfectly well, if both the bodies are ſufficiently electrical.

Experiments and Obſervations on bulbous Roots, Plants, and Seeds growing in Water; by Mr. Curteis. Phil. Tranſ. N° 432. p. 267.

MR. *Curteis* took a couple of common penny garden pots, and corked up the holes at the bottoms: he painted the pots, and puttied the corks, that no water might drain thro'; then he had a couple of boards, cut to fit the tops of the pots, bored with ſeven holes at equal diſtances, to to place his bulbs in, and likewiſe as many ſmall holes for placing of ſticks, to tye the ſtems of the flowers to: He then planted hyacinth, narciſſus's, tulips, and junquils, and filled the pots with water up to the board, ſo that the bulbs ſtood only upon the water, where they blowed very well, and made the fineſt appearance, beyond any flower-pots that could be dreſſed by gathered flowers. After the bloom was over, he ſet them out in his garden, as not worth preſerving; where they ſtood till towards *Midſummer*, and he took no farther care than giving them at times freſh water, as it perſpired or evaporated; and when the rains filled the pots, he emptied them down to the boards again; but the bulbs ſhrinking, ſome of them ſlipp'd thro' the holes, down to the bottom of the pot; and about *Midſummer* when their leaves began to grow yellow, he went with a deſign to pull them up, and throw them away; but he was ſurpriſed to find the bulbs buried in the water, grown firm, and too large to be drawn back thro' the holes, being ſound and fit for blowing the next year, and increaſed in off-ſets: This put him upon another experiment of blowing his bulbs under water; which he found anſwer beyond expectation; for they rather out-did thoſe, that grow in the ground, in the ſtrength of their ſtalks, clearneſs of their bloſſoms, laſting of their bloom, and the difference of their ſeaſons; which may be ſo managed, according to the warmth of the rooms, they are kept in, as to have the ſame ſorts in flower from *Chriſmaſs* till the natural time of their bloom in the open ground, which is *March* and *April*.

But finding it very troubleſome to keep the boards fixt under water, he thought lead might anſwer the purpoſe better; whereupon he procur'd ſome ſheet lead of about 4 pounds to the foot, cut ſo as to fit his pot, and made holes in it proportionable to the bottoms of his bulbs, and likewiſe ſmall holes to fix ſticks for the ſupport of the leaves and ſtems of the flowers; he put a little coarſe ſand in the bottom of the pots, thinking it would ſupport the ſticks, and keep them ſteady: But when he came to make uſe of the ſticks, the ſand gave way. He then made falſe bottoms with lead, and cut holes oppoſite to thoſe in the top, which anſwer'd his purpoſe. Upon taking up the bulbs to put in theſe falſe bottoms, he found the ſand had corroded the fibres, and changed them all like iron-mould, that he thought they were ſpoil'd: but rincing them in 2 or 3 wateres, it came clear off,

G. Smith delin. Hulett Sculp.

... doing his lasts autumn, and planting the bulbs ... ter, and filling them up with fresh water, they ...ted, and never changed again in the clear water, but ...d and put forth their flowers very kindly ; tho' by the ex... periments he had made, before he could do them right, ... had often planted and transplanted them. But he found ... afterwards that glass jars of the form represented in Pl. XIII. ... are more convenient, both for seeing the progress the roots ... make, and for knowing when they want to be changed.

Fig. 1. Pl. XIII. represents one of these glass jars, con... taining the following flowers:

1 Golden lamp } *Narcissus*
2 Bolleman }
3 Keysers jewel }
4 Pulchra } *Hyacinths*
5 Janus }

Fig. 2. represents the profile or section of the same jar. ... the sticks to tie up the leaves and stems of the flowers. ... the upper lead with holes to support the bulbs and sticks. ... the under lead with holes to keep the sticks steady.

By several experiments on dried bulbs and those that were taken fresh out of the ground, he finds the dried ones do best. For, those taken growing out of the ground being full of moisture, will not so soon upon changing the element, agree with a new one ; the fibres they had struck in the ground always rot, and they must make new ones in the water, whereby they require a long time before they can recover themselves enough to flower. The bulbs will not rot ; yet they will not be so strong, as those put into the water when dry, which fill themselves with moisture by degrees: Therefore, when he plants his bulbs, he lets them at first on the top of the water: For, he found by 2 or 3 experiments, that those planted under water did not push out their fibres so strong, as those set upon the water ; the reason of which he takes to be, that they were filled with water too soon ; whereas those set upon water attracted it by degrees, and so made both the fibres and bulbs grow stronger ; and then about 5 or 6 weeks after planting them, as the fibres push out, he gradually fills the water higher and higher, till the whole bulb be cover'd ; and so keep the off, and on fixing his false bottoms, and placing the bulbs in their holes, and filling them up with fresh water, they recover'd, and never changed again in the clear water, but thriv'd and put forth their flowers very kindly; tho' by the experiments he had tried, before he could fix them right, he had often planted and transplanted them. But he found afterwards that glass jarrs of the form represented in Pl. XIII. were more convenient, both for seeing the progress the roots made, and for knowing when they want to be clean'd.

Fig. 1. Pl. XIII. represents one of these glass-jarrs, containing the following flowers.

1 Golden sun } *Narcissus's*
2 Bosselman }
3 Keysers jewel }
4 Pulchra } *Hyacinths*
5 Janus }

Fig. 2. represents the profile or section of the same jarr; *a* the sticks to tie up the leaves and stems of the flowers; *b* the upper lead with holes to support the bulbs and sticks; *c* the under lead with holes to keep the sticks steady.

By several experiments on dried bulbs, and those that were taken fresh out of the ground, he finds the dried ones do best: For, those taken growing out of the ground, being full of moisture, will not so soon upon changing the element, agree with a new one; the fibres they had struck in the ground always rot, and they must make new ones in the water, whereby they require a long time before they can recover themselves enough to flower. The bulbs will not rot; yet they will not be so strong, as those put into the water when dry, which fill themselves with moisture by degrees: Therefore, when he plants his bulbs, he sets them at first on the top of the water: For, he found by 2 or 3 experiments, that those planted under water did not push out their fibres so strong, as those set upon the water; the reason of which he takes to be, that they were filled with water too soon; whereas those set upon water attracted it by degrees, and so made both the fibres and bulbs grow stronger; and then about 5 or 6 weeks after planting them, as the fibres push out, he gradually fills the water higher and higher, till the whole bulb be cover'd; and so keep them till

till the bloom is over, and the ſeaſon for drying them returns.

He was ſurpriſed at one obſervation, *viz.* two of his hyacinths were mouldy, which would canker and eat holes thro' ſeveral of the coats or ſcales; this he picked and cleaned ſeveral times; but ſtill it ſpread farther and farther: but ſoon after they were cover'd with water, he could perceive them heal by degrees, till they became perfectly ſound, and blew their flowers as kindly, as thoſe that had continued perfectly ſound.

By another experiment he tried what bulbs would do if kept all the year round under water: He left in water a *Narciſſus*, a hyacinth of *Peru*, and ſeveral junquils, that were planted in *October* 1732; and which became as ſound and ſtrong, as thoſe he took out and dried, and promiſed fair for a bloom; he obſerv'd that their old fibres do not rot, till they are ready to puſh out new ones.

Another obſervation ſeems worthy of notice; one of his double hyacinths, commonly call'd Keyſer's jewel, brought 2 pods of ſeed to maturity, which he has blow'd for 14 or 15 years ſucceſſively in the ground, and could never find them make any thing towards ſeeding; and he has reaſon to think that ſeveral other bulbs would have ſeeded, if he had taken timely care of them; but he did not perceive it, till it was too late.

Mr. *Miller* in *Phil. Tranſ.* N°. 418. intimates that bulbs ſet in glaſſes grow weaker, and ſhould be renew'd every year with freſh ones; but Mr. *Curteis* obſerves, by this way of raiſing them under water, that at their taking up, they are as large and ſome of them ſtronger than when they were planted, and if they be dried at the proper ſeaſon, will produce a ſecond year as well as freſh ones.

Mr. *Curteis* likewiſe planted *ranunculo's* and *anemone* roots, which grew and ſhot up the ſtems of the flowers very ſtrong; but the buds of the flowers were blaſted, which he is apt to think happened from their being crowded too much, having no convenience to give them freſh air enough.

He alſo planted *auricula's* and pinks; the pinks flower'd, but the *auricula's* were not ſtrong enough; both of them were ſtill growing, and he was in expectation they would blow next ſeaſon.

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He alſo tried ſeveral ſhrubs, as roſes, jeſſamines and honey-ſuckles; which all grew and ſhot out freſh fibres; and the roſe tree made 6 ſtrong buds for bloſſoms, but accidentally ſetting them out in a hot ſun-ſhiny day in *April*, they were all ſcorch'd up, that they came to nothing. He obſerv'd that ſtrong ſuckers cut off 2 or 3 inches under ground, without any fibres, grew the beſt.

By another experiment he was willing to try what the ſucculent plants would do in this way: He took a leaf of the *opuntia* or *Indian* fig, and laid it by to dry 3 weeks or a month, till it had loſt all its moiſture, and was nothing but a dried ſkin: He then planted it in water in the beginning of *July*, and tied it to a ſtick that was fixt in one of his leads; and he filled the pot ſo, that the bottom of the leaf was $\frac{1}{4}$ of an inch in the water; in about a month's time the leaf filled, ſtruck out fibres and put forth a freſh leaf, which was growing, and making as much progreſs as ſuch a plant would do in the earth, in the ſame ſpace of time.

Dr. *Mortimer* told Mr. *Curteis* he had placed beans upon water, which bloſſomed and podded: This put the latter upon trying the experiment with them, and peaſe at the ſame time. He planted 6 beans in a pot, and fixed ſticks in it to ſupport the ſtems as they grew; they bloomed as freely as thoſe planted in the ground, but did not pod ſo well, having not above a pod or two on each, which came to perfection, and ripened their ſeed; but this might happen for want of a little more experience: The peaſe, which were of the dwarf ſort, grew a little too much, and only put out 3 or 4 bloſſoms at the extremity of the tops, but every bloſ-ſom brought a peaſe cod, and ripen'd its ſeed.

This growth of the beans and peaſe made Mr. *Curteis* imagine that other ſeeds would ſucceed in the ſame manner, knowing they would chip upon being laid for a little time in water, or in a moiſt place: The only difficulty was to invent ſome thing proper for their ſupport in growing. The firſt thing he tried was boring very little holes in a piece of lead, fixt in a pot, and ſowing the ſeeds thereon: He found they would ſprout; but as the water evaporated, filling in freſh mov'd the ſeeds from their places, that they could not fix themſelves to turn the radicle down into the water: He then tried tow or hemp, and ſpread it on the lead, which he found anſwer the purpoſe of ſupporting the ſeed, which by that means grew; and the radicle taking hold of the tow, it was enabled to throw up its plume or ſhoot; he then tried ſeveral ſorts of ſmall ſeeds, and found they would all grow, tho' he made the experiment about *Chriſtmas*: But he found the tow diſcolour'd the water, and gave an offenſive ſmell, and that the ſeed did not thrive kindly: He then tried wool and cotton; the cotton being too buoyant, would not anſwer the purpoſe ſo well: But wool, when juſt buried in water, being like a jelly, and not drying ſo ſoon on the top, even tho' the water has left it, entirely anſwers the purpoſe as well as ſowing them in the earth; and if the ſeed be good, will keep clean for 2 or 3 months: For, this way of ſowing will diſcover whether the ſeed be mixed with old ſeed. He ſow'd ſeveral ſorts of ſallad ſeeds in this way, and they came to as great perfection, as thoſe of the ſame kind rais'd in hot beds: And thus they may be produced in any room or garret, early in the ſpring; and ſo on till late in autumn, and the cold weather comes in; and afterwards in the middle of winter, in a room where a conſtant fire is kept. He had ſeveral ſallads in ſpring, 1733, and the autumn following, by ſowing different ſorts every week one under another, in ſmall halfpenny pots; as lettuce, creſſes, white muſtard, rape, and raddiſh, which in a fortnight after ſowing would be fit to cut: So that keeping a proper ſucceſſion, he had every week a tolerable ſallad for 2 or 3 perſons.

His way of ſowing theſe ſeeds is to have a piece of lead bored full of holes, and made to fit the pot, about half an inch below the top; then filling it with water, he takes a little clean wool and ſpreads it even and thin, upon the ſurface of the lead, quite home to the ſides of the pot, which will then look like a jelly; if there be too much water, he pours it off, till the wool only appear cover'd or filled with water; then he ſows the ſeed pretty thick, and in 48 hours it will begin to chip; and in a fortnight after ſowing will be fit to cut for a ſallad.

He obſerved from ſeveral experiments, that any of theſe plants tranſplanted out of the earth into water would not thrive kindly; but thoſe rais'd in water may be tranſplanted into earth; ſo that this method of raiſing ſeeds in water may be of uſe in a dry ſeaſon, to be pricked out into the earth, tho' they will not come up in ſuch a ſeaſon, if ſown in the ground; yet tranſplanted from water they will take as freely to the earth, as if rais'd in it.

Mr.

Mr. *Curteis* thinks that from the foregoing experiments in water, we may come at a better way of planting in the earth, especially some roots, which are apt to rot in the ground, as *anemone's*, *ranunculo's* and hyacinths; and that from an observation he frequently made, but never before took notice enough to improve it; which is, that he has often seen a bulb drop'd by chance upon the ground, strike out fibres stronger and more numerous than those planted in their usual depth of earth would do. The use he would make of this observation is, that when he plants his bulbs, he takes out the earth of the bed, he designs to plant, as deep as the bulbs or roots are to stand when planted, and he places his bulbs on the surface, till the moisture of the earth shall have attracted their fibres, and they begin to shoot up their plume; and then by degrees he covers them over to the thickness of mould, that they should stand in; by which means they will be in no danger of rotting, after they have got strong fibres: For, when we plant these bulbs or roots, it is generally either too wet or too dry; if it be a wet season, the bulbs are too soon saturated with moisture, which rots them; and if it be too dry, they lie so long, before they can attract moisture enough to make them vegetate, that they grow mouldy, and are render'd dry and hard as a piece of stick; so that the first rain infallibly rots them.

N. B. These experiments were made without the benefit of any sun, all his windows lying open to the north.

As these experiments have open'd a new scene of knowledge in the vegetable world, and may be of great use in natural philosophy, and particularly improve the art of gardening; it is to be hoped the curious will carry on the enquiry, as they have leisure and opportunity.

Directions for planting bulbous roots in pots or glasses of water.

When the leaden false bottoms are fixed down tight, within 2 or 3 inches from the bottom of the pots (which is only designed to hold the sticks steady that are to support the leaves and stems of the flowers) lay on the lead, which is to support the bulbs, placing the notched part opposite to that in the false bottom, as near as the sticks, when placed, will suffer it; then place your bulbs in each hole, and fill in water up to the lead, which will then touch the bottom of the bulb; and as the water evaporates or perspires, keep it filled to that height, till the bulbs have struck their fibres pretty strong into the water, which may be in a month or 6 weeks; then fill in water about half an inch

inch above the lead, and by degrees as the fibres ſtrengthen, and the plume or head ſprouts, fill it higher and higher till the bulbs be entirely buried under water, which muſt be continu'd till the ſeaſon for drying them returns.

But you muſt obſerve at the planting the bulbs to clean them very well from any foulneſs they may have at their bottoms, by ſcraping them with the point of a knife, till the ſound part of the bulb appear; and likewiſe clear them of all their looſe ſkins, and even the brown ſkin, till they appear white; which otherwiſe will diſcolour and foul the water that ſhould be kept as clear as poſſible; and for this reaſon, the notches in both the leads are contrived, that upon ſhifting all the water out of the pots, if there happen to be any ſediment, by ſhaking the pots once or twice as it is pour'd off, all the foulneſs may come with it: But this ſhifting of the water need not be done but once or twice in a winter, or whenever you ſee occaſion by the diſcolouring or foulneſs of it; and at the ſame time it will be neceſſary with a painter's bruſh to clean off all ſlimineſs adhering to the ſides of the pots and bulbs, and rince them well, by pouring water on them at a little diſtance: By this method they may be kept perfectly clean; and at any time when the outward ſkins of the bulbs looſen and begin to decay, clear them off, otherwiſe they would occaſion foulneſs; and whenever you ſee duſt ſwimming on the ſurface of the water, fill the pot full, and let it run over, which will carry it all of; and then pour off the water to its uſual height.

N. B. Plant bulbs of equal bigneſs, at leaſt in height together in the ſame pot, that they may have the ſame benefit of the water; therefore, Mr. *Curteis* plants narciſſus's and hyacinths, and bulbs of that ſize together; tulips and junquils, *&c.* by themſelves; and *crocus* and ſnow-drops, *&c.* by themſelves.

The Caſe of a Man *who was poiſon'd by eating* Monks-hood *or* Napellus; *by Mr.* Vincent Bacon. Phil. Tranſ. N° 432. p. 287.

ABOUT 10 at night Mr. *Bacon* was call'd to one *John Crumpler*, a ſilk weaver, in *Spittlefields*; when he came into the room, he found him lying on the bed, with his head ſupported by a by-ſtander, his eyes and teeth fixt, his noſe pinch'd in, his hands, feet and forehead, cold, and all in a cold ſweat; no pulſe to be perceiv'd, and his breath ſo ſhort as ſcarce to be diſtinguiſh'd: Upon enquiry Mr. *Bacon* was told that he had been very well all day, and about 8 had eat a very hearty

hearty supper of pork, and a sallad drest with oil and vinegar; that immediately after he began to find an indisposition: That the sallad consisted of common sallad herbs, bought at a stall in the market, except some salary, picked out of their own garden. Mr. *Bacon* suspecting that he had been eating some poisonous herb, ask'd if he found in the beginning of the disorder any inclination to vomit? And he was told, none; but that when he found his illness come upon him with great violence, he thought himself poison'd, and forthwith drank a large quantity of oil, about a pint in all; and after that loaded his stomach with carduus-tea till he vomited; and tho' he threw up the greatest part of his supper, yet the symptoms still increas'd, which made Mr. *Bacon* be sent for: But before he could get to him, things were come to the extremity above-described: Having nothing at hand but a tea spoonful or two of spirit of hartshorn, he forced open his teeth with the handle of a spoon, and as his head was reclined, he pour'd the spirit into his mouth, which rous'd him a little and first set him a coughing, and next a vomiting: Mr. *Bacon* took the advantage of the little sense that was returned, and continued plying the patient with carduus-tea, till he had vomited several times more; but he could not hinder his swooning often between the times of reaching, tho' he gave him after each time 40 or 50 drops of *sal volatile* & *Tinctur. croc. a a p. æ.* in a glass of wine; the patient at length began to find a working downwards, as he afterwards express'd himself, which was follow'd by a stool; after which he vomited 2 or 3 times more, and then he said his head was so heavy, and his strength and spirits so exhausted, tho' his stomach and bowels were much easier, that he must needs lie down: His pulse was then a little returned, tho' very much interrupted and irregular, sometimes beating 2 or 3 strokes very quick together; and then making a stop of as long or a longer time than the preceeding strokes together took up. Having observ'd that what he had last vomited was little more than the pure carduus-tea, Mr. *Bacon* gave him a draught made of *Aq. Epidem. Ther. Androm. Conf. Alkerme, &c.* and gave orders to make him some sack whey to drink between whiles, sometimes alone, and in case of great faintness, with some of the abovementioned drops. It being near 1 o'clock, Mr. *Bacon* left him; and calling to see him next morning, he found him much better: The patient had lain awake, tho' still an hour or two after he left him; but being very cold and chilly had a great deal of covering laid upon him, and then he had a kindly warmth come over

over his limbs, ſucceeded by a moderate ſweat, and then a quiet ſleep of 4 or 5 hours from which he waked very much refreſh'd: His ſenſes had never fail'd him but during the ſwoonings. Mr. *Bacon* could ſee none of the ſallad but the ſalary, which being the produce of their own garden, the boy who gathered it the evening before, was order'd to fetch ſome more of the ſame; he preſently brought a ſpecimen, which Mr. *Bacon* took to be the common *Monks-hood* of our gardens, called by *Moriſon* in his *Prelud. Botan. Aconitum ſpicâ florum pyramidali.*

The alterations the patient found in himſelf after eating it, and the manner they came on, were as follows: The firſt ſymptom was a ſenſation of a tingling heat, which not only affected his tongue but his jaws; ſo that his teeth ſeemed looſe, and his cheeks ſo much irritated, that the people about him, nay even his looking glaſs could ſcarce perſuade him, but that his face was ſwell'd to twice its proper ſize: This tingling ſenſation ſpread itſelf farther and farther, till it had taken hold of his whole body, eſpecially the extremities; he had an unſteadineſs in the joints, eſpecially of the knees and ancles, with twitchings upon the tendons, ſo that he could ſcarce walk a-croſs the room; and he thought that in all his limbs he felt a ſenſible ſtop or interruption in the circulation of the blood; and that from the wriſts to the finger ends, and from the ancles to the toes there was no circulation at all; but he had no ſickneſs or diſpoſition to vomit, till he took the oil, &c. Afterwards his head grew giddy, and his eyes miſty and wandering; and next, a kind of humming or hiſſing noiſe ſeem'd continually to ſound in his ears, which was follow'd by the abovementioned *ſyncope's*.

A woman, who had ſupped with the patient, having before been out of order, and not then perfectly recover'd, eat but ſparingly, but took this ſuppos'd ſalary along with the other herbs; and felt and complained of all the ſame ſpmptoms, but in a leſs degree than the man had done. She would not be prevail'd on to vomit, but only took the cordial draught above deſcribed: The man became quite well, but the woman continu'd ſtill out of order: And yet there was not put into the whole ſallad more than what grows upon one of the roots.

Auroræ

Auroræ Boreales *observed at* Witemberg *in* 1732; *by* M. Weidler, Phil. Trans. N° 432. p. 291. *Translated from the* Latin.

FEb. 18. 1732, O. S. about 9 in the evening, the sky serene, there appeared an *aurora borealis*: For, at that time a black arch, whose middle was 20 degrees high, was seen in the north, where a little before, that same evening, the sky was observed serene. The part of the heavens over the black arch was white, and from it at times, shot forth the usual radiations of the *lumen boreale*, or the luminous pyramids; as also very thin white vapours, like small clouds, were carried with a swift motion towards the vertex.

At 10 o'clock the motion of the luminous matter seemed to cease for some time; yet presently from that white part of the heavens white undulating vapours issued; but the representation of a canopy near the vertex was not seen.

At 30 minutes after 10, the white *fascia* of the dark arch was dilated; but the bright vapours came out from it more sparingly.

The shining pyramids arose on both sides near the north point; but the fluctuating vapours were more frequent towards the west: The air was all the time still and calm.

Oct. 12, 1732, O. S. immediately after 6 in the evening, there again appeared an *aurora borealis*; namely a dark arch was expanded between N N W. and N E. Above the arch there was a remarkable bright space of the heavens, about 10 degrees broad, but not exactly expressing the figure of an arch. The broader portion declined about 10 degrees from the north to the west; and from thence, as from the fountain of the luminous matter, at 30 minutes after 6, many white pyramids issued, which almost reached the very zenith; some of them were red and vanished soon; one in particular, extended between the *Crown* and *Hercules*, continued for a longer time up to the very zenith: M. *Weidler* observ'd only one radiation to the N. E. In a quarter of an hour this sportive scene was ended. The clouds, which before stood unmoved to the west, driven by a southerly wind, were diffused, and tended to the east: Yet under them to the east the bright part continued, and the black arch was set below the horizon; the white arch that was over the black one, descended together with the clouds below the horizon; and both the darkness and the thin clouds being dissipated,

pated, at 7 o'clock the ſky became on all hands ſerene: Yet all that night a thin light poſſeſs'd the northern part of the horizon.

Beſides theſe, which M. *Weidler* himſelf obſerv'd; there were likewiſe other *lumina borealia*, but not ſo bright, on the 30th of *Mar.* 13th of *Apr.* 11th and 30th of *Aug.* 1732, O. S. but as to their particular phenomena he had no certain account.

By theſe and other obſervations M. *Weidler* had taken of this northern light, he was more inclined to Dr. *Halley*'s ſurmiſe, that its ſeat is about the magnetic pole; or at leaſt that its motion is in ſome meaſure governed and determined from thence.

As to the effect of the *aurora borealis*, it does not hitherto ſufficiently appear; only M. *Weidler* obſerv'd that generally one or more very clear days immediately ſucceed it. The *Swedes* and *Norwegians*, to whom this phenomenon frequently appears, are ſaid to have learned by long experience, that the *northern light*, when it ſhines more frequently about the beginning of autumn, portends milder weather and a plentiful harveſt; on which ſcore, they commonly call it Kornmod, i. e. *the ripening of corn*. They likewiſe reckon its frequency in winter to preſage and indicate ſevere cold; as M. *Leopold* gives Dr. *Woodward* an account in his *Relatio epiſtolica de itinere ſuo Suecico*, p. 19. *Edit. Lond. Anno* 1720. To the former hypotheſis agree the experiments taken at *Witemberg* in autumn 1731: For, on the 4th, 7th, 8th, 10th and 23d of *October* 1731, N. S. a very frequent and bright *lumen boreale* was obſerved, which was ſucceeded by ſuch ſeaſonable weather, that corn and fruit were very plentiful in 1732.

Of the deſtroying the Caterpillars *and* Locuſts, *that infeſted the neighbouring Parts of* Witemberg; *by the ſame.* Phil. Tranſ. N° 432. p. 294. *Tranſlated from the* Latin.

AMongſt the particular obſervations of the year 1732, the following is worth mentioning, namely, the deſtroying the caterpillars and locuſts, that for ſeveral years before had in a melancholy manner eat up the fruits of the earth in the northern parts of the circle of *Saxony*, the *Marckt* of *Brandenburgh*, in *Luſatia*, and probably in other places. In ſpring 1732 both theſe ſorts of inſects were produced in incredible numbers. The caterpillars in ſeveral places ſoon deſtroyed all the leaves both of barren and fruit trees; and the locuſts likewiſe threatned again the greateſt deſtruction to the fruits of the earth

earth as the preceeding years: The country people, therefore, began to dig several pits, and gather the locusts that had not strength enough to fly, into them, and so cover them with earth and kill them.

But this contrivance would have been of little avail, had not these insects been providentially weakened and destroyed by some inclemencies of weather; in such manner that they all soon perished the beginning of the summer, before they could propagate: For, after that the kindly heat of the sun about the beginning of *April*, 1732, O. S. had invited them from their nests sooner than ordinary, and this heat was succeeded by a sudden severe cold for some nights, as of the 15, 16, 17 and 18 of *April*, and likewise by cold and plentiful showers of rain on the 22. of *Apr*. and 19. of *May*; and afterwards by constant and plentiful rains about the latter end of *May*, and for the greatest part of *June* and *July*; on these accounts it was, that these noxious animals did not arrive to their usual size and strength of body: So that they were still small, about the beginning of *June*, and had not reach'd to that just proportion of their limbs, to which they usually arrive about this time of the year. The locusts, in particular, impatient of wet, were in the beginning of *July* found dead all over the fields; and many of them, that had retired into the longer stalks of herbs and flowers, and had stuck close to them by their mouths, hung dead from them. That this, probably, was the cause of the destruction of the locusts, appears pretty evident; because we find by experience, that this species of insects frequents the higher and drier grounds only, and nestle there, and always avoid the low valleys. As to the shape of these locusts, they were different from the green ones, commonly observed every year, in the fields and meadows, and which are few in number. The colour of the head and back was black, and in some, grey, with yellow specks interspersed; their belly was yellowish; the muscles of the hinder feet red; and when they were on wing, they looked of a purple colour. The bodies of most of them were not above 1 $\frac{1}{2}$ inch in length; tho' in *Aug*. 1731 M. *Weidler* observed some shrivell'd up, to be upwards of 2 geometrical inches. In the same month the male and female copulate, each dam contains upwards of 30 eggs, which they lay in holes made in the earth; and at the close of *September* they die upon them. M. *Weidler* was told, that 4 years before, when they first came to these parts from *Poland* thro' *Lusatia* and the *Marckt* they flew high in the air in a body, in the middle of summer, above

above the tops of the houses and turrets; so that at a distance they had the appearance of a cloud.—On whatever place they alighted, they covered it quite, and spread far and wide. They seemed to be fond of the more tender tops of the ears of corn, to gain which the better, they cut down the entire unripe ear; and this they did especially in the night time. M. *Weidler* was told by credible persons, that in one night the ears of whole fields were cut down in such manner, that in some villages the poor farmers had not even the seed they sow'd.

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